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INTELLIGENCE TEST SCORES AND BUSINESS SUCCESS[1]

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SUMMARY

One hundred and two business men attending the Babson Statistical Conference at Wellesley Hills took the Bureau of Personnel Research Test VI, a spiral-omnibus form of the Army Alpha intelligence examination. The group was a representative sampling of successful business men: salesmen, sales managers and executives.

The scores ranged from 27 to 174; median, 106; interquartile range, 88 to 128. (The maximum possible score on Test VI is 184.) In terms of the army intelligence scale, 54 per cent of these men would be rated A; 29 per cent, B; and 17 per cent, C+ or C.

Two of the three lowest scores were made by presidents of their concerns. But it is to be noted that even these are fully equal to the average American in intelligence. Every individual in the entire group is in the upper half of the population; which suggests that at least this minimum of mental alertness as measured by an intelligence test, is important for business success.

To discover possible differences of vocational profile, an analysis was made of the relative proficiency of older and younger executives, sales managers and salesmen, in each of the six types of question included in the test: disarranged sentences, arithmetic, opposites, number completion, analogies

[1] Read in part at the meeting of the American Psychological Association, Madison, December 28, 1923.

and information. The most significant differences are that the salesmen did better than the executives on disarranged sentences, and less well on arithmetic and number completion. Business men with college training did better upon disarranged sentences and opposites than men with less schooling.

Each man who took the test was notified by mail of his score and its meaning, and was asked to fill out an experience record. Of the 102 who took the test, 73 returned experience records. These had made, on the average, better scores than had those who did not respond.

Using the data contained in these experience records, ratings of the business success of these 73 men were made by five judges, independently. The extent of agreement among these judges is indicated by the intercorrelation between their ratings: an average coefficient of +0.60.

The combined success ratings, when correlated with the scores on Test VI, give a coefficient of −0.10. In other words, no significant relationship was found between intelligence as measured by this type of mental alertness examination, and relative business success—within this successful group—as estimated from data on a personal history blank.

The correlation between years spent in school and test score is +0.44. Many other correlations with test performance were computed, as well as correlations between items on the experience records; but the number of cases proved to be too small to lend significance to the relationships disclosed.

The question is brought forward as to the relative significance of intelligence and of non-intellectual traits of personality as factors in business success.

I. INTRODUCTION

Does outstanding success in business depend primarily on intelligence? To what extent may it be assumed that the brighter a man is, the farther he will go on the road toward business achievement? Do brains count for more than character and personality?

University teachers are prone to magnify the importance of intelligence. It is, indeed, likely to be the chief factor in their own success. They tend to estimate the effectiveness of their colleagues in terms of intellectual accomplishment. They rank their students in order of ability to master and manipulate ideas.

In the world of business, on the other hand, success is first of all a matter of getting things done. Ability to persuade and control people is an outstanding asset. Effectiveness within an organization demands such traits as dependability, coöperativeness, energy, promptness of decision. If traits like these are present in high degree, a man may make a notable business success even though his mental alertness test rating on the Army scale is only B or C. Intelligence there must be, above a certain minimum. But this minimum is, perhaps, not so high as is often supposed.

It is the purpose of this paper to report some intelligence-test measurements of a group of business executives; to indicate the range and distribution of test scores within this group; to compare them with other business men; and to note the relationship of certain personal history items to estimated success as well as to proficiency in different parts of the test, and to total score.

II. SUBJECTS; PERSONAL HISTORY DATA

One hundred and two business men attending the annual statistical conference held at the Babson Institute, Wellesley Hills, Massachusetts, August 4, 1922, constitute the sample selected for study. About half of these men were college graduates and a fourth of the remainder had attended high school. Nearly four-fifths were executives. One-fifth were salesmen. (Eleven sales managers are here classed with executives.) There were wide differences in age as well as in education and in type of work. The executives ranged from twenty-five to sixty-three years. For statistical purposes they were divided into two groups, younger and older, at

the median age of forty-one. The ages of the salesmen ranged from twenty to fifty-nine with the median at thirty-one years.

Personal history data regarding the men examined were needed, to furnish a criterion for use in evaluating the share of intelligence in business success. We wanted, also, to see to what extent certain items such as experience, or schooling, correlate with business success or differentiate salesmen from executives. Seventy-three of the men examined were kind enough to furnish the desired personal history data, and the bulk of this report concerns itself with an analysis of these data, an attempt to extract from them a criterion of success, and a study of certain correlations between (*a*) this criterion, (*b*) test scores, and (*c*) selected items of personal history.

The form used for getting the personal history data is a typical application blank which calls for the following information: name, date, address, date and place of birth, lineage (American, English, Hebrew, etc.), height, weight, number of dependents, marital status, schooling, account of how time has been spent since leaving school, salary in last three positions and reasons for leaving, time spent in inside (retail) selling, time spent in outside selling, occupations of relatives, forms of investment now owned, amount of indebtedness, membership in clubs, in fraternities, in business organizations, in church; offices held in these organizations, participation in sports, attendance at social affairs, physical infirmities, time lost through illness and nature of illness.

Of these items, the following yield data expressible in quantitative units, and so can be used in computing correlations: age, height, weight, number of dependents, salary, years selling, number and kinds of investments, debt, number of clubs, number of times attended theater last year, number of times took part in athletics last year, number of times attended social affairs of own sex last year, number of years in school.

A few additional items permit of statistical, though less rigorous, treatment. Of these, only the data on schooling and present occupation were studied.

With reference to schooling, the men were classified as follows:

1. No schooling	1
2. Went to grammar school but did not graduate	4
3. Graduated from grammar school	2
4. Went to high school but did not graduate	7
5. Graduated from high school	11
6. Went to college but did not graduate	8
7. Graduated from college	40
Total	73

As to present occupation, we recognized three classes: executives, salesmen, and those difficult to classify. For instance, No. 69 answered that the nature of his work was "advertising." This gave little clue as to whether he was an executive, a salesman, or what not. Eleven sales managers were classed with the executives. The group of 73, on whom personal history data were secured, was made up of 42 business executives, 20 salesmen, and 11 doubtful.

In average height, the salesmen are a trifle taller. The executives, both older and younger, center about 5 feet 7½ inches; the salesmen, 5 feet 9 inches.

The fact that the answers to a question can be objectively scored or evaluated does not insure that the information is reliable—it may be only an expression of the subject's estimate, or again, an intentional over- or under-estimation. The items seem to exhibit three grades of reliability:

1. Reliable items: Age, number of dependents, number of years in school, height and weight.

2. Fairly reliable items: Salary, years spent in selling, number of kinds of investments.

3. Items of uncertain reliability:

Number of clubs: (The answers to this question were not very full. Many of the well-known clubs do not appear in any of the blanks and as it is hardly possible to believe that none of these representative men belonged to such clubs, little use has been made of this item.)

Debt: (Upon this point approximations have very evidently been made. Those who had small debts of a personal nature and who were young or relatively poor seem to have given precise answers—i.e., they were not in round numbers. Those men who were in business for themselves and had large loans outstanding gave answers in round numbers, if at all.)

Number of times took part in various forms of athletics or sports during last year.

Number of times took part in social affairs of own sex during last year.

Number of times attended theater during last year.

(Men who have taken part in any one of these but a few times could give fairly explicit answers, but many replies are obviously rough approximations. The only use finally made of the data on athletics and sports was to consider the number of different kinds of activities in which the subject engaged.)

III. THE CRITERION

The criterion of business success was a composite rating based entirely on the information contained in the personal history records. Ratings were made independently by five men on the staff of the Division of Coöperative Research, Carnegie Institute of Technology. The raters were instructed to examine these records and to classify each case—in comparison with the entire range of business men—as belonging to one of four groups: very successful (score 1), successful (score 2), below average success (score 3), business failure (score 4). They were directed to give consideration to age: an older man should have progressed farther in the business world than a younger man equally successful. These composite success ratings were then divided into quartiles. These four classes are referred to hereafter as Success Rating A, B, C and D; Rating A signifying the highly successful quartile, and D the least successful quartile of the group.

The average rating proved to be 2.19. Since the average rating for the business population is, by definition, 2.5, it is

evident that either the judges tended to rate too high, or else the group as a whole is distinctly above the average in business success. The latter is undoubtedly the case.

The reliability of these ratings is not as high as we would wish. The intercorrelations between the ratings given by the five judges range from +0.53 to +0.65, the mean being +0.60, P.E. ±0.04.[2] The ratings may be considered to have only a moderate degree of reliability, but it supplies the best criterion available under the circumstances.

It may be of interest to ask which items on these experience records most influenced the raters in estimating relative success, and to note what relationship was found between their composite success ratings and various personal history items. We shall later compare the success ratings with relative proficiency in the several types of question used in the intelligence test.

The correlations found between the composite success ratings and a number of personal history items are as follows:

	r	NUMBER OF CASES
Years in school	0.00	73
Age	+0.17	73
Number of dependents	−0.43	73
Salary	+0.76	32
Years spent in selling	+0.18	43
Number of kinds of investments	+0.27	71
Weight	+0.02	72

Apparently the number of years a man has attended school does not influence the rating of success. The age factor was held fairly constant. The number of kinds of investment shows a positive relationship with the ratings. Doubtless it influenced, to some degree, the opinions of the judges. Salary, when stated, was clearly the outstanding criterion of success in the minds of the raters, as it correlates +0.76 with

[2] All correlation coefficients computed according to Pearson product moment correlation formula.

their ratings. The number of dependents correlated negatively with these ratings of business success (−0.43).

Not all of the items appearing on the Experience Records lend themselves to statistical treatment by the Pearson product moment formula. Below are a few of those that do:

	NUMBER	r	P.E.
Age and number of dependents	73	+0.58	±0.05
Age and salary	32	+0.54	±0.08
Age and number of kinds of investment	71	+0.21	±0.08
Number of dependents and salary	26	+0.33	±0.11
Number of kinds of investment and salary	31	+0.50	±0.09
Indebtedness and salary	29	−0.23	±0.12
Years spent in selling and times attended social affairs of own sex in last year	32	+0.18	±0.12

IV. THE MENTAL ALERTNESS TEST

The intelligence test known as Bureau of Personnel Research Test VI was used. This test is an adaptation of Army Alpha. It contains no questions not found in the Army test. It uses all the questions in six of the eight parts of Army Alpha, omitting only part I, the oral directions test, and part III, the test of practical judgment. The other six types of question, including arithmetic, analogies, opposites (synonym-antonym), range of information, number series completion and disarranged sentences, are used in apparently chance sequence. But actually the examination is of the spiral-omnibus form: each question of a given type is in general more difficult than the question of the same type which last preceded it. Two pages of instructions and fore-exercises serve to familiarize the person to be examined with the six varieties of tasks; then, at a given signal, he turns the page and proceeds without further instruction to answer as many of the questions as he can within a time limit of fifteen minutes.

Advantages of this form of examination, as compared with Army Alpha, are that it can be given by any one without

special elocutionary training; instead of eight time limits it has only one; and it can be scored rapidly and easily by stencil. The Bureau of Personnel Research has used this test since 1919 with several thousand subjects, and finds in general that it is quite as reliable as Army Alpha, and distinctly easier to administer. But it is less convenient to score if it is desired to study the relative proficiency of the subjects in the different parts of the test.

The formula for scoring this test is

$$\text{Score} = A - (O - \text{W} - 2w')$$

in which A = number of items gone over
O = number of items omitted up to that point
W = number of items wrong with the exception of opposites and disarranged sentences
w' = number of opposites and disarranged sentences wrong

(A mere guess at the answer to an opposites question has an even chance of being correct. This holds also of the disarranged sentences where the *true-false* response is used. Consequently penalty for error on one of these questions is made two points instead of one.)

Another way of putting this same formula is

$$\text{Score} = R - w$$

where R = answers right
w = opposites and disarranged sentences wrong

To compare the mental alertness of this group with the performance of other groups of business people, we used the following norms, compiled by the Bureau of Personnel Research from 843 cases distributed as follows: 537 life insurance salesmen, 160 specialty salesmen, 131 executives, 15 secretaries.

Norms for Test VI

SCORE IN TEST VI	DECILE STANDING
130–184	10
118–129	9
109–117	8
102–108	7
95–101	6
88– 94	5
79– 87	4
67– 78	3
50– 66	2
0– 49	1

(Decile standing shows in what tenth of all persons tested this person belongs—10 indicates the highest 10 per cent and 1 the lowest 10 per cent. For example, a person making a score of 106 would have a decile stand of 7.)

The general interpretation of the deciles is as follows:

Decile 10.....very high
Decile 8, 9.....high
Decile 4, 5, 6, 7.....average
Decile 2, 3.....low
Decile 1.....very low

V. TEST RESULTS

The number of men whose scores fall in each decile of the Bureau of Personnel Research norm is as follows:

NUMBER	DECILE
19	10
14	9
14	8
13	7
9	6
9	5
8	4
8	3
5	2
3	1
102	

Obviously, this group averages distinctly higher in intelligence score than did the group of 843 which furnished the Bureau of Personnel Research norms. Nineteen make scores in the "very high" decile, while only 3 are in the "very low" decile.

The wide distribution of test scores, from 27 to 174, is shown in table 1 which gives the range, the median and quartiles for the entire group and also for the following sub-groups: salesmen, sales managers, executives, and sales managers and executives combined.

TABLE 1

Distribution of test scores

	NUMBER	LOWEST	Q_1	MEDIAN	Q_3	HIGHEST
Salesmen	22	54	90	103	112	174
Salesmanagers	11	77	94	107	128	155
Executives	69	27	84	107	128	162
Executives and salesmanagers	80	27	86	107	128	162
Total	102	27	88	106	128	174
Old norm	843		74	94	112	

The median score for our entire group is twelve points higher than the median of the norm.

The executives did better, on the whole, than the salesmen, although a young salesman made the highest score, and 2 of the 3 who scored the lowest of all are presidents of their concerns![3]

How do these test performances of business men compare with those of officers and soldiers in the Army? Fifty-four per cent of our group made scores which correspond to an A intelligence grade on Army Alpha. Twenty-nine per cent made a B grade; and seventeen per cent, grade C+ or C. Yoakum and Yerkes[4] report the percentages of men of

[3] One of the writers interviewed the man who made the lowest score, and found him to be a kindly old gentleman, apparently approaching senility. He would probably have made a much higher score five years ago.

[4] Army Mental Tests, New York, Henry Holt, 1920, p. 27.

different groups making A and B grades in Army Alpha as follows: officers, 83.0 per cent; officers' training school candidates, 73.2 per cent; sergeants, 53.4 per cent; corporals, 39.7 per cent; literate privates, 18.8 per cent. *Eighty-three per cent of the group we are studying are men of this superior caliber, a fraction identical with that found among the army officers.*

Each man's score was mailed to him, together with a request to supply the data called for on the personal history blank, and 73 responded. The 29 who did not return the experience record had made a larger proportion of less-than-average scores. The higher the score, the greater was the willingness to furnish personal history data. This fact reduces the spread of our sample and diminishes the likelihood of correlation, within this sample, between test score and estimated success.

	NUMBER	MEDIAN
Supplying personal history data	73	113
Not supplying data	29	97
Total	102	106

Figure 1 shows the distribution of test scores for the entire group and also for these two sub-groups. The tendency is obvious for those making higher scores to answer the experience questionnaire and for those making lower scores to neglect to do so.

The coefficients of correlation of test scores and several of the personal history items are as follows:

	NUMBER OF CASES	r	P.E.
Number of years in school	73	+0.44	±0.06
Age	73	−0.35	±0.07
Number of dependents	73	−0.19	±0.08
Salary	32	−0.14	±0.12
Years spent in selling	43	−0.36	±0.09
Number of kinds of investments	71	−0.28	±0.07
Height	72	+0.08	±0.08
Success ratings	73	−0.10	±0.08

The success rating, when correlated with the test scores, gives −0.10, P.E. ± 0.08. As the factor of age enters into both of these, a partial correlation was computed holding that factor constant. The partial obtained is −0.04. Business success as estimated by these judges from the available data shows no relation *within this group* to mental alertness as measured by Bureau of Personnel Research Test VI.

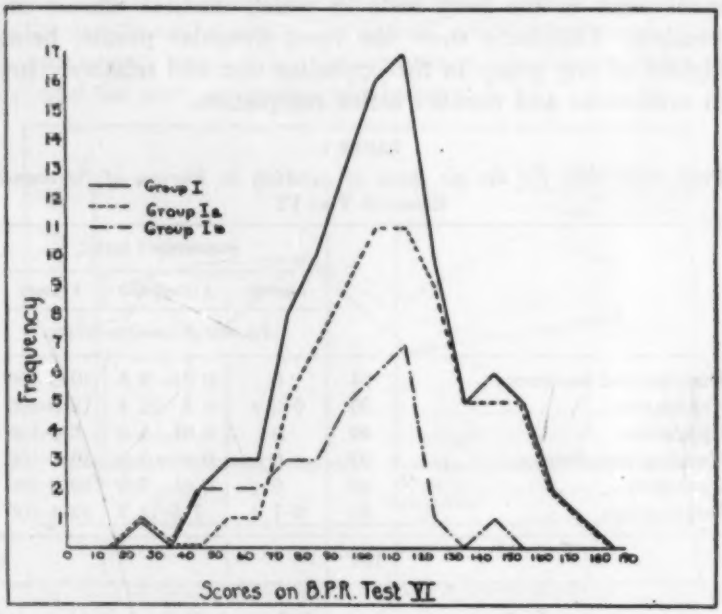

FIG. 1. FREQUENCY CURVES OF SCORES ON TEST VI

Group 1a, those supplying personal history data; group 1b, those neglecting to do so.

Cobb and Yerkes[5] have made a study of the relative ability of officers of the different arms of the Army service in the eight parts of Army Alpha. A percentile distribution of scores on each of the eight tests was prepared from the records

[5] Cobb and Yerkes, Intellectual and educational status of the medical profession as represented in the United States army. Bulletin of the National Research Council, vol. 1, part 8, February, 1921; p. 473 ff.

of 15,000 officers of all arms. Then psychographs were drawn, showing for each test the median percentile score made by medical, infantry, artillery and other officers in comparison with the standard group. Striking contrasts appeared. Medical officers, for example, did relatively better in opposites and disarranged sentences than in arithmetic, number series completion and analogies. Engineers, on the other hand, excel most in the very tests in which medical officers are weakest. Chaplains show the most irregular profile, being highest of any group in the opposites test and relatively low in arithmetic and number series completion.

TABLE 2

Proficiency table for the six types of question in Bureau of Personnel Research Test VI

		PROFICIENCY INDEX		
		1 (good)	2 (medium)	3 (poor)
		Per cent of questions wrong		
Disarranged sentences	24	0	0.01– 9.9	10.0–100
Arithmetic	20	0–2.4	2.5 –12.4	12.5–100
Opposites	40	0	0.01– 4.9	5.0–100
Number completion	20	0	0.01– 9.9	10.0–100
Analogies	40	0	0.01– 9.9	10.0–100
Information	40	0–7.4	7.5–12.4	12.5–100
	184			

To make a similar comparison of the relative proficiency of our subjects in the six types of question in the Bureau of Personnel Research test, it was necessary to devise a different method of analyzing the data. A table was prepared showing for each "total number attempted" the number of each sort of question which the person tested had had an opportunity to answer. For example, if 36 questions were attempted, the table shows that 5 of these are disarranged sentences, 4 arithmetic, 8 opposites, 4 number completion, 7 analogies, and 8 information. After computing, by aid of this table, the

per cent of the problems attempted that each person had right in each of the six types of question, a proficiency table was made (table 2). This table was derived by dividing the "per cent wrong" scores of each type of question in tertiles. Thus, on the arithmetic questions, one-third of the men had less than 2.5 per cent wrong, one-third had from 2.5 up to 12.5 per cent wrong; and one-third had more than 12.5 per cent wrong. These three groups were designated "good," "medium," or "poor," in arithmetic. The "good" are referred to as having a "proficiency index of 1;" the medium, a "proficiency index of 2;" and the poor, a "proficiency index of 3."

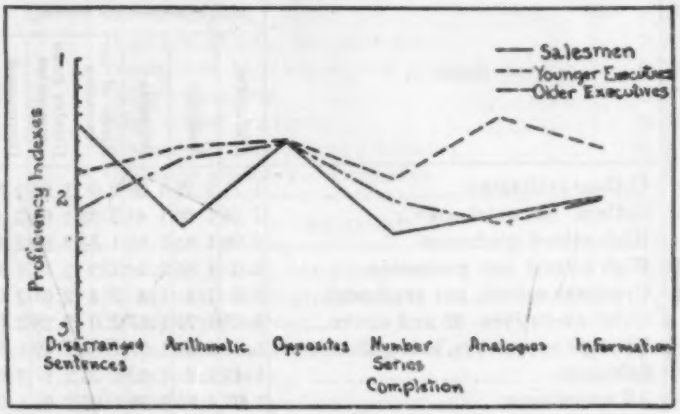

FIG. 2. PROFILES OF SALESMEN AND EXECUTIVES

The smaller the index, the higher the proficiency

By reference to this table, the proficiency of a man on any type of question can be stated in terms of his tertile position in the group. A profile can then be drawn which shows at a glance in which kinds of questions he is weak, in which strong. Then, by computing the mean proficiency of any group—salesmen, for example—on each type of question, a profile of the group can be drawn which shows graphically its characteristic excellencies or defects in the several sorts of task set by the examination. (See figure 2.) Only the tests of the 73 men who returned their experience records were analyzed in

this way. Then the mean proficiency indexes were computed for different groups, so that a profile could be drawn for each group, and any outstanding group characteristic—such as facility in analogies or relative narrowness of range of information—would be instantly apparent.

Table 3 gives for each group its six proficiency indexes, one for each type of question. Table 4 shows which groups are most successful in each type of question.

TABLE 3

Proficiency of different groups on the six types of question

NUMBER	GROUP	PROFICIENCY INDEX					
		Arithmetic	Analogies	Opposites	Range of information	Number series completion	Disarranged sentences
39	College graduates	1.71	2.21	1.36	2.0	1.85	1.89
9	College, not graduates	1.55	1.66	1.44	2.33	1.68	2.11
11	High school graduates	2.09	1.81	1.83	1.54	2.09	2.18
7	High school, not graduates	2.0	1.85	2.14	2.0	2.14	1.85
5	Grammar school, not graduates	2.6	1.4	1.4	2.4	2.6	2.0
21	Older executives, 42 and above	2.07	1.71	1.57	2.0	2.18	2.0
21	Younger executives, below 42	1.81	1.61	1.57	1.85	1.42	1.61
20	Salesmen	1.45	2.2	1.60	2.25	2.1	2.0
42	All executives	1.97	1.85	1.59	1.92	2.0	1.95
10	Salesmen, college graduates	1.7	2.7	1.5	2.4	2.0	1.6
5	Salesmen, college, not graduates	1.4	1.6	1.4	2.2	1.2	1.6
20	Executives, college graduates	1.8	2.05	1.4	1.85	2.45	1.8
7	Executives, high school graduates	2.28	1.71	1.71	1.28	1.85	2.14
5	Executives, high school not graduates	2.0	1.8	1.8	2.4	2.4	1.8

The figures under each type of question in table 3 are the proficiency indexes. It is to be kept in mind that the higher the proficiency, the smaller is the index number. The possible range is only from 1 to 3, so a difference in the first decimal place may be significant. For example, salesmen who went to college but did not graduate have an average proficiency index in disarranged sentences of 1.4; while the corresponding

TABLE 4

Groups in order of proficiency

CASES	GROUP	PROFICIENCY
	Disarranged sentences	
5	Sales-college men, not graduates	1.4
20	Salesmen	1.4
9	College men, but not graduates	1.55
10	College graduates, salesmen	1.7
39	College graduates	1.71
20	Executives, college graduates	1.8
21	Younger executives	1.81
42	All executives	1.97
7	High school men, not graduates	2.00
5	Executives, high school, not graduates	2.00
21	Older executives	2.07
11	High school graduates	2.09
7	Executives, high school graduates	2.28
5	Grammar school, not graduates	2.6
	Arithmetic	
5	Grammar school, not graduates	1.38
5	Sales, not college graduates	1.60
21	Younger executives	1.61
9	College men, not graduates	1.66
21	Older executives	1.71
7	Executives, high school graduates	1.71
5	Executives, high school not graduates	1.8
11	High school graduates	1.81
42	All executives	1.85
7	High school men, not graduates	1.85
20	Executives, college graduates	2.05
20	Salesmen	2.20
39	College graduates	2.21
10	Salesmen, college graduates	2.7
	Opposites	
39	College graduates	1.36
5	Sales, not college graduates	1.40
5	Grammar school, not graduates	1.40
20	Executives, college graduates	1.40

TABLE 4—*Continued*

CASES	GROUP	PROFICIENCY
	Opposites—(Continued)	
9	College men, not graduates	1.44
10	Sales, college graduates	1.50
21	Older executives	1.57
21	Younger executives	1.57
42	All executives	1.57
20	Salesmen	1.60
7	Executives, high school graduates	1.71
5	Executives, high school, not graduates	1.80
11	High school graduates	1.83
7	High school men, not graduates	2.14
	Number completion	
7	Executives, high school graduates	1.28
11	High school graduates	1.54
21	Younger executives	1.85
20	Executives, college graduates	1.85
42	All executives	1.92
39	College graduates	2.00
21	Older executives	2.00
7	High school men, not graduates	2.00
5	Salesmen, not college graduates	2.2
20	Salesmen	2.25
9	College men, not graduates	2.33
10	Salesmen, college graduates	2.40
5	Grammar school, not graduates	2.40
5	Executives, not high school graduates	2.40
	Analogies	
5	Salesmen, not college graduates	1.20
21	Younger executives	1.43
9	College men, not graduates	1.66
39	College graduates	1.85
7	Executives, high school graduates	1.85
42	All executives	2.00
10	Salesmen, college graduates	2.00
11	High school graduates	2.09
20	Salesmen	2.10

TABLE 4—*Continued*

CASES	GROUP	PROFICIENCY
	Analogies—(Continued)	
7	High school men, not graduates	2.14
21	Older executives	2.18
5	Executives, not high school graduates	2.40
20	Executives, college graduates	2.45
5	Grammar school, not graduates	2.60
	Information	
10	Salesmen, college graduates	1.60
5	Salesmen, college, not graduates	1.60
21	Younger executives	1.61
20	Executives, college graduates	1.80
5	Executives, not high school graduates	1.80
7	High school, not graduates	1.85
39	College graduates	1.89
42	All executives	1.95
21	Older executives	2.00
20	Salesmen	2.00
5	Grammar school, not graduates	2.00
9	College men, not graduates	2.11
7	Executives, high school graduates	2.14
11	High school graduates	2.18

index for the group who did not graduate from grammar school is 2.6. The difference is 1.2, which is 60 per cent of the total possible difference.

In table 4 the reader may consider the relative performance of the different groups in each type of question separately. The groups are listed in the order of their proficiency in each kind of task. As an aid in estimating reliability, the number of cases in each group is given. The groups are, for the most part, so small that the differences in their performance are not significant.

Disarranged sentences. There is evident a definite tendency for the college men who are salesmen to do well, and for older executives and executives who are high school men to do

poorly, in disarranged sentence questions. Schooling seems to affect performance, and also age. Note that the younger executives have an index of 1.81, while the older executives have one of 2.07. The older men do somewhat less well than the younger. The salesmen do markedly better upon this type of question than do the executives.

Arithmetic. Proficiency in questions involving arithmetical reasoning is strikingly different from proficiency in disarranged sentences. The greater the amount of schooling beyond grammar school, the lower the relative proficiency. The executives do better than the salesmen here. But these trends are not so striking as in the disarranged sentence questions.

Opposites. In general, schooling seems to have some influence on performance here. The college men do best, while the poorest scores on the average are made by the high school men. No difference is seen between the average performance of groups engaged in different types of work.

Number series completion. In this type of question the executives do much better than the salesmen. The group "all executives" has an index of 1.92, while the salesmen have one of 2.25. It is curious that at either end of the list is a group of executives—one, the best, being high school graduates; the other, the poorest, being men who went to high school but did not graduate. Except for these two small groups, schooling shows no relationship with proficiency.

Analogies. Age seems to be a factor. Younger executives do well in this type of task, making an average index of 1.43; while for the older executives the index is 2.18, a difference of 0.75. Occupation and schooling are not seen to correlate with proficiency.

Information. No groups exhibit outstanding differences of proficiency upon questions involving general information. Both age and schooling might be expected to affect performance, but there is only a slight positive relationship.

Such of these findings as are positive, are indicators of tendencies only. It would be unsafe to draw conclusions

from meagre data, and folly to draw fine distinctions. Tendencies here observed are, then, merely indications of possible differences between groups. Where large differences have been found, further investigation is indicated. Thus, we would suggest that disarranged sentences, arithmetic, and number completion problems be included in tests designed to differentiate prospective salesmen from other business men, the hypothesis being that superiority in disarranged sentences, coupled with inferiority in arithmetic and number completion, is more often typical of salesmen.

CONCLUSIONS

Most of the business men who served as subjects in this study are far above the average American in general intelligence. Ninety-five per cent of the group have an A or B intelligence rating, indicating how rare it is for a man of only average intelligence to achieve a degree of business success comparable with the success of this group. These men are not only more intelligent, but they are on the whole superior also in business success.

Within this selected group, success in business, as estimated from items on a personal history record, does not correlate with intelligence as measured by a fifteen-minute group test.

The salesmen, as a group, were more proficient upon disarranged sentence questions than were the executives. The executives, on the other hand, were more proficient upon arithmetic and number completion questions. Proficiency on the arithmetic questions shows a negative correlation with schooling beyond grammar school. Proficiency in opposites differentiates the occupational groups not at all, but shows some correlation with schooling.

Business men who make superior test scores are more apt to reply to a personal history questionnaire.

Relative success in business can be estimated only with moderate reliability from data obtained on a typical personal history record form. Better criteria of business success are wanted.

The negative correlation of −0.35, P.E. ±0.07 between age and mental test score should not be construed as unambiguous, since the group probably contained a selection of brighter young men and less bright older men.

Possibly some factor of selection may also account, in part, for the interesting correlation between years of schooling and test score: +44, P.E. ±0.06. To some degree, the brighter the boy, the longer he tends to stay in school before entering on a business career. Schooling does not, however, show a significant correlation with the criterion of business success.

Better criteria of success are required, as well as more severe and thorough intelligence examinations, in order to measure with accuracy the share which mental alertness contributes to accomplishment in business. But the evidence in hand suggests that superiority in intelligence, above a certain minimum, contributes relatively less to business success than does superiority in several non-intellectual traits of personality.

EXPERIMENTAL STUDIES IN VOCAL EXPRESSION

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I. THE PITCH FACTOR IN VOCAL EXPRESSION

In the year of 1918–1919 there was registered in the graduate school of the University of Wisconsin, as a candidate for an advanced degree in Speech, a man whose voice was a striking example of monopitch. The man was about thirty years of age, had been a successful school administrator in a large city, and was very keen intellectually. In an attempt to find some adequate cause for the peculiar vocal limitations of this student, his sense of pitch was tested in the laboratory and it was found that his limen of pitch discrimination was considerably above the maximum difference which can be measured with an ordinary set of tuning forks. A difference of 30 d.v. (435 to 465) was not perceptible to him.

Under the circumstances it was not difficult to draw the tentative inference that the subject's vocal monopitch was causally connected with his auditory deficiency; all a priori considerations pointed strongly in that direction. It has long been a commonplace of psychology that the ear is the guiding factor in voice. The intimate, though inadequately understood, relation of the auditory and the motor speech areas in the cortex has long been known. The absence of articulate speech in the congenitally deaf and the diminution of accuracy and skill in vocal expression invariably associated with other types of deafness, indicate the dependence of voice upon audition. For these and other reasons it has been supposed that vocal expression must be in some sense a function of auditory processes. Scripture merely expresses the consensus of opinion among psychologists when he says: "The sensory-

motor control is generally muscular and auditory. The learning of speech consists largely in forming connections between the motor sensations and the auditory ones."[1] Seashore says: "All this wonderful control of pitch in the speaking voice is conditioned upon the presence of capacity to hear pitch."[2] This investigation was begun as an attempt to add something to the understanding of this ear-voice relationship and, despite the side excursions into other fields, this problem has remained central throughout the studies.

The unsolved problems of vocal expression are legion. One can never be sure as to the value of the detached facts which are likely to appear in the course of pioneer experimentation in any field. Only when a science has reached a considerable degree of advancement can results be assessed finally and with assurance. The value of negative results should not be overlooked; many times it may be quite as important to learn that an alleged relationship does *not* exist as that it *does*. Any experimental cultivation of the field of vocal expression is likely to uncover facts which, although not immediately useful, at some later stage in the development of the science may be synthesized and appraised.

The phonautograph

According to Scripture, "The first attempt at recording speech was made by Scott in 1856."[3] Scott's notion was that by modelling his apparatus upon the mechanism of the human ear he might get a graphic record of air vibrations. His account of his early experiments was published in 1861 under the title, "Inscription automatique de sons de l'air au moyen d'une oreille artificielle." In 1864 he published a second article in which he named his instrument a "phonautograph." In describing this apparatus, Scripture says: "A large parabolic

[1] E. W. Scripture, The Elements of Experimental Phonetics. Yale University Press, 1902, p. 389.

[2] C. E. Seashore, The Psychology of Musical Talent. Silver, Burdett, and Company, 1919, p. 62.

[3] E. W. Scripture, op. cit., p. 17.

receiving trumpet carried at its end a thin membrane whose movement caused a small recording lever to write upon the smoked surface of the drum. The sounds of the voice passing down the receiver agitated the membrane and caused the lever to draw the speech curve on the drum."[4] This machine, was the prototype of all the phonautographs which have been used by later investigators.

About ten years after Scott's invention, Barlow began his experimental studies of the human voice. He called his recording device a "logograph."[5] Most of the modifications which have been made in the phonautograph since Scott's day have been in the diaphragm and in the writing lever. In the former, various investigators have used: rubber, cork, collodion, gold-beater's skin, and the membrana tympani. The writing lever has generally been made of glass or aluminum. Pipping substituted a diamond for the glass thread. Among those who have worked with the phonautograph, Scripture mentions: Koenig, Schneebeli, C. Blake, Preece, Stroh, Hensen, Wendeler, Martens, Hermann, E. Blake, Chavanon, Rigollot, Lebedeff, Samojloff, and Rousselot. Readers who may be interested in a detailed bibliography on the phonautograph will find the principal materials cited in Scripture's *The Elements of Experimental Phonetics*, pages 17 to 31.

The phonautograph used in these studies was designed and constructed by Dr. C. L. Hull and myself in the psychological laboratory at the University of Wisconsin. There were in the instrument no essential departures from the typical phonautographs which have just been mentioned. We used a kymograph drum which was rotated by a small electric motor of variable speed. Upon a rack and pinion support[6] were mounted the tambour carrying the glass writing lever, and

[4] E. W. Scripture, op cit., p. 17.

[5] Barlow, On the pneumatic action which accompanies the articulation of sounds of the human voice, as exhibited by a recording instrument. Proc. Roy. Soc. London, 1874, xxii, p. 277.

[6] Universal Support, E. Zimmerman Leipzig. C. H. Stoelting Co., Chicago.

time-marker controlled by a large electrically maintained tuning fork set to break the circuit twenty times per second. As the subjects spoke into the mouth-piece the experimenter lowered the writing lever and the time-marker on the drum by turning the thumb-screw on the support. Thus the tracings were made to form descending spirals on the smoked paper. The drum could be rotated at whatever speed seemed most desirable in any given case. If the speed was reduced, the tracing was made small and laterally compact; if the speed was increased, the tracing was drawn out and laterally magnified. The use of the time-marker made it possible to vary the speed of the drum without modifying the essential character of the tracing.

The most delicate task in the building of the apparatus was constructing and mounting the writing lever. This was made from an ordinary solid glass rod which was heated over a Bunsen burner until it was molten and then quickly drawn out into a very slender filament. It was found to be desirable that the lever should taper slightly and uniformly; if the tapering was irregular, the segmental vibrations of the filament were too much intensified. When first drawn out, the lever was straight from end to end. The writing point, which had to work in vertical movements parallel to the side of the drum, was made by holding the smaller end of the filament at some distance above the gas flame until the end was heated to degree at which it crooked sharply downward from its own weight. Then the point was removed farther from the flame until it became molten again and formed a minute drop or ball at its extreme tip. This ball minimized the friction of the writing point on the smoked paper and produced a more satisfactory tracing than was otherwise possible.

The face of the tambour was covered with a piece of dental rubber dam stretched to a moderate degree of tension and held in place by a rubber band which drew it into a groove in the sides of the tambour. The optimum tension of the membrane had to be determined by trial and error. Upon this membrane, attached to it by a single drop of glue, with the

bend of the point in a plane parallel to the top of the tambour, was mounted the writing lever.

When the phonautograph had been constructed, the first question to be answered was: How reliable are the tracings which it produces; how accurately do they present to the eye the physical character of the sounds for which they stand? On this matter Scripture expressed the following opinion, in 1902:

> It is sometimes said that the speech machines do not faithfully record the vibrations of the air; this is true to a certain extent. The speaking tube and the diaphragm reinforce or weaken some of the tones, but the influence is chiefly on the very high ones. . . . . The friction of the recording point greatly reduces the size of the vibrations and modifies them chiefly by rounding off the corners. The inertia of the recording lever also has some influence. Just how much detail has been lost, and how much distortion has occurred cannot be known with machines of this phonautograph type because the records cannot be turned back into speech.[7]

Four years later, a great deal of experimentation having intervened, he concluded that the phonautograph had no value as a recorder of *quality* or *timbre*, and that it was useful for the study of vocal *pitch* changes only.[8]

In some of the voice tracings obtained in the present studies, there seemed to be a considerable amount of rather interesting looking detail of wave form. However, careful observation tended to corroborate Scripture's judgment as to the impossibility of making a qualitative analysis of vocal sound through phonautographic records. The conclusions of earlier investigators as to wave form, phonetic elements, etc., are of exceedingly doubtful value.

So far as the element of *intensity* is concerned, the case against the phonautograph is even clearer. It was obvious that the writing lever of our instrument responded far more sensitively to certain vibration rates than to others. The degree of tension of the diaphragm, the length and weight of

[7] E. W. Scripture, op. cit., p. 30.

[8] E. W. Scripture, Researches in experimental phonetics. Carnegie Institute Publications, 1906, p. 13.

the lever, the quality of the tone; all seemed to produce distortion in the record. Miller holds that, due to the factors of friction and momentum, Koenig's tracings are worthless with respect to both *quality* and *intensity*.[9]

Two elements of sound remain clearly within reach of phonautographic analysis: *time* and *pitch*. These two constitute "the melody of voice" which Scripture concluded might be studied with the apparatus. This limitation of our investigation to the *time* and *pitch* factors in vocal expression is not so serious as might at first appear. *Pitch* is indissolubly bound up with *quality* and *intensity*. Seashore says, "The experience of tone is the experience of pitch."[10] Watt says, "The whole interest of the psychology of the auditory attributes must obviously center on pitch."[11] And again, "The most characteristic difference between tones is undoubtedly given by their pitch, and it is more or less natural to think that hearing several pitches means hearing several tones."[12] Clearly then, a study of the pitch element in vocal expression should result in the discovery of some significant facts.

But was our phonautograph a reliable recorder of vocal pitch? First the instrument was tested as to its accuracy in recording the pitches of several standard tuning forks. The modus operandi was as follows: A tin writing point was mounted in wax on one prong of a fork; the fork was struck upon the beater and then while the writing point on the fork was placed in contact with the smoked paper on the drum, the other prong of the fork was touched lightly against a rubber drum-head which had been stretched over the bell of the glass mouth-piece. This test was made for forks 128, 256, 320, 512, 1024 d.v., and for several others both higher and lower than the limits of vocal pitch. In every case, a

[9] D. C. Miller, The Science of Musical Sounds. Macmillan and Co., 1916, p. 73.

[10] C. E. Seashore, op. cit., p. 30.

[11] H. J. Watt, The Psychology of Sound. Cambridge University Press, 1917, p. 20.

[12] Ibid., p. 56.

comparison of the parallel tracings showed that they were absolutely identical in vibration rate. Counting the number of vibrations per second as marked off on the time line was an easy and certain check on the accuracy of the timing device.

The control of vocal pitch and the memory for pitch

Having established the reliability of the phonautograph as a recorder of pitch, we were ready to use the instrument for the discovery of significant facts about vocal pitch. To that end, two groups of subjects were chosen and studied: *first, as to their control of vocal pitch; second, as to their memory for pitch, and finally, as to the character and amount of their inflectional modulation in the utterance of a selected bit of verse.*

The first subjects were 20 young women students in an elementary speech class. Their training in vocal expression and in music was substantially uniform. These subjects were first tested for pitch discrimination; a set of standard tuning forks was used, the testing was necessarily individual, and the right and wrong case method was employed. The limen of pitch discrimination for each subject is shown in table 1.

The subjects were then familiarized with the phonautograph and with the technique of making a record. When this had been accomplished, a tuning fork (320 d.v.) was struck on the beater and held in close proximity to the ear of the subject who was asked to hum the note of the fork. The record was made when the subject announced that she felt reasonably certain of being on the correct pitch.

The vibrations in each of twenty consecutive divisions on the tracing were counted. (As has been explained, each division represents $\frac{1}{10}$ of a second.) The total amount of deviation from the standard was computed by adding the deviations in each of the twenty divisions; the deviation in a given division being the difference between the number of vibrations in the tracing and 16 d.v. which represented the rate of the fork which was used. The total deviations of the several subjects may be seen in table 1. It will be noted that the subject showing the greatest accuracy is no. 5 who varied

not a jot from the norm. The most inaccurate subject was no. 1 whose total deviation was 32 d.v. The average amount of deviation for the group was 6.07 d.v. per second.

TABLE 1

Control of vocal pitch and memory for pitch (20 women)

SUBJECTS	LIMEN OF PITCH DISCRIMINATION MEASURED BY FORKS	AVERAGE PITCH OF SYNCHRONOUS REPRODUCTION FROM FORK 320 D.V.	VARIATION FROM NORM IN SYNCHRONOUS REPRODUCTION	VARIATION FROM NORM AFTER FIVE-MINUTE INTERVAL	VARIATION FROM NORM AFTER TEN-MINUTE INTERVAL
	d.v.	d.v.	d.v.	d.v.	d.v.
1	12.0	288.0	32.0	38.5	20.0
2	4.0	319.0	4.0	13.5	17.0
3	2.0	317.5	3.5	10.0	5.0
4	6.0	319.5	5.5	15.5	8.0
5	2.0	320.0	0.0	2.0	7.5
6	3.0	317.0	3.0	11.0	20.0
7	4.0	318.5	1.5	8.0	13.0
8	6.0	304.5	15.5	5.5	10.5
9	0.5	316.5	3.5	6.0	2.5
10	5.0	302.0	18.5	22.5	14.0
11	1.5	320.5*	0.5	4.0	2.0
12	1.5	318.0	2.0	1.5	7.0
13	0.5	316.0	4.0	26.5	28.0
14	0.5	316.5	3.5	11.5	4.5
15	2.0	315.5	4.5	1.0	7.0
16	0.5	316.5	3.5	7.5	12.5
17	1.5	317.5	3.5	3.0	4.5
18	5.0	314.5	5.5	16.5	21.0
19	1.0	317.0	4.0	17.5	14.0
20	4.0	316.5	3.5	4.0	6.0
Totals.....	63	6291	121.5	221.5	224
Means.....	3.01	314.55	6.07	11.07	11.4
A.D.....	2.05	4.95	4.72	7.12	5.9
P.E.$_M$.....			0.89	1.34	

* Above pitch of fork.

The procedure just described was followed with 23 male subjects, also students in a beginning speech course; with these differences: whereas the sense of pitch in the case of the first group of subjects was measured with tuning forks, the Sea-

shore phonograph discs were used for the second group, and the pitch norm was furnished by a 128 d.v. fork. Table 2 shows the records of these 23 men.

TABLE 2

Control of vocal pitch and memory for pitch (23 men)

SUBJECTS	PERCENTAGE SCORE ON SENSE OF PITCH (SEASHORE RECORDS)	AVERAGE PITCH OF SYNCHRONOUS REPRODUCTION OF FORK 128 D.V.	VARIATION FROM NORM IN SYNCHRONOUS REPRODUCTION	VARIATION FROM NORM AFTER FIVE-MINUTE INTERVAL
		d.v.	*d.v.*	*d.v.*
1	86	135.5*	7.5	5.0
2	63	140.0*	12.5	1.0
3	85	98.0	30.0	2.0
4	63	130.0*	2.0	44.5
5	74	156.5*	28.5	36.0
6	85	127.0	1.0	18.0
7	75	122.5	5.5	3.5
8	82	127.0	1.0	4.5
9	82	126.5	1.5	1.5
10	86	129.5*	1.5	2.0
11	64	141.5*	13.5	34.5
12	83	124.0	4.0	0.5
13	84	105.0	23.0	8.5
14	88	126.5	1.5	4.5
15	69	147.5*	21.5	21.0
16	53	124.0	4.0	3.0
17	74	123.0	5.0	3.0
18	83	128.5*	0.5	1.0
19	70	94.0	34.0	33.0
20	87	126.5	1.5	10.5
21	90	126.0	2.0	23.0
22	65	127.0	1.0	26.0
23	76	124.0	4.0	12.5
Totals.....		2910	206.5	299
Means.....		126.52	8.97	13
A.D.....		8.54	8.71	11.47
P.E.$_M$.....			1.53	2.02

* Above pitch of fork.

The best record among the men was made by subject 18 whose total variation from the norm was 0.5 d.v. The average

total deviation for the group of men was somewhat higher than that for the group of women; 8.97 as against 6.07. The average deviations of the figures in the third columns of tables 1 and 2 indicate that there is less variation among the women than among the men. All of the women, with the exception of no. 11 who was slightly sharp and no. 5 who was absolutely on the key, were flat. Eight of the men were sharp and 15 of them were flat in their synchronous reproduction of the pitch.

It might be supposed that accuracy in producing vocal pitch is a direct function of the sense of pitch. The coefficient of correlation (Pearson's) between sense of pitch and accuracy in the production of vocal pitch was found to be +0.808 for the women and +0.081 for the men. The cause of the disparity between these two coefficients is not clear. As has been said, the measures of pitch discrimination for the first group were made individually with tuning forks, whereas those for the second group were made with the Seashore phonograph records. It should also be said that in the latter case the test was given only once and practice effects may have destroyed its validity. Then, too, the number of subjects in the groups was so small as to render the reliability of the coefficients very dubious.

In the tracings of vocal pitch there was practically no fluctuation for the one second of time.

After a subject had done the best he could to reproduce the pitch of a tuning fork synchronously with hearing it, he was asked to sit quietly for an interval and then to hum from memory the tone which he had heard. The women were asked to do this after an interval of five minutes and again after a second interval of like duration. The results of the first memory trial are shown in the fourth column of table 1. The most accurate record was made by subject 15 whose total deviation was 1 d.v. Strangely enough, this subject was more accurate in reproducing the pitch of the fork from memory than she had been when it was sounding in her ear. The most inaccurate record, as in the former instance, was made by

subject 1 whose total deviation had increased to 38.5 d.v. The average amount of deviation for the 20 subjects had risen from 6.07 to 11.07. Four of the 20 were closer to the norm from memory than they were when they were listening to the fork.

The results of the second memory test are shown in column 5 of table 1. The average of this column is 11.4, an inconsiderable increase over the average of 11.07 for the first memory trial. After this second interval, subjects 1, 8, 9, 10 did better than they did when they were actually hearing the fork. Subjects 1, 3, 4, 9, 10, 11, 14, 19, a surprisingly large proportion of the group, were more accurate after the lapse of ten minutes than they were after but five minutes. The average loss in accuracy after the first interval was exactly 5 d.v.; after the second interval it had risen very slightly to 5.325 d.v. Sharping and flatting were not differentiated in computing total amounts of deviation.

The group of men were tested after only one interval of waiting. The fourth column of table 2 shows their memory records. Almost 50 per cent of the group, subjects 1, 2, 3, 7, 12, 13, 15, 16, 17, 19, showed the anomalous tendency to get closer to the norm when humming from memory than they could when they were hearing the pitch sounded. Yet the average for the group rose from 8.97 to 13, or an average loss in accuracy of slightly more than 4 d.v. The most accurate memory record was made by subject 12; this was just equal to the best record in the 3rd column. The least accurate memory record was that of subject 4 whose score was just about 50 per cent worse than the poorest score made in the synchronous trials.

One very clear indication from this rather inadequate study is that individuals differ very widely in ability to produce vocally a tone which they are hearing or have heard. A careful examination of the data presented in tables 1 and 2 may cause a good many questions to arise. Most of them must await more experimentation before they can be answered satisfactorily. It would seem that more evidence may be

needed before we can accept unreservedly Seashore's statements concerning the comparative accuracy of men and women in voice control as indicated by pitch singing. He says: "Men and women sing in their respective ranges with equal accuracy, vibration for vibration of error."[13] In the present tests, the women seem to have better memory for pitch and greater pitch control than the men have. Of course the small number of subjects again warns us not to be too sure of our conclusions on this point. The reliability of the differences between men and women in vocal control and memory for pitch is very low. In vocal control the difference is 2.9, the P.E. is 1.77, and the formula for reliability $\frac{D}{(\text{P.E.}_D)}$ yields 1.63. The coefficient of reliability is therefore 0.8671. In memory for pitch the difference is 1.93, the P.E. is 1.83, and the coefficient of reliability is 0.7601.[14]

Inflectional modulation

We shall now attempt to indicate some of the ways in which the use of the phonautograph may shed light upon the many interesting problems of inflectional modulation in vocal expression. The experiments on this matter utilized subjects from the two groups who had been studied as to pitch memory and control; 19 of the 20 women, and all of the 23 men.

First, the material to be uttered vocally had to be selected. Since the investigation was to be focussed upon pitch, it was decided that the prime requisite of the language should be the prominence of the inflectional element in its effective vocal rendition. Several bits of literary material, both prose and verse, were tried out. In these preliminary trials, the fallibility of the unaided ear was shown repeatedly. A few words which seemed to be spoken effectively only with a relatively large amount of inflection, when recorded by the phonautograph, often revealed little pitch change. Finally, Austin

[13] C. E. Seashore, op. cit., p. 199.

[14] E. L. Thorndike, Mental and Social Measurements. Columbia University, 1913, p. 200.

Dobson's dialogue in verse, "Tu Quoque," was suggested. Several excerpts from this seemed to fill the bill better than

Vocal Reproductions of Pitch of Tuning Forks

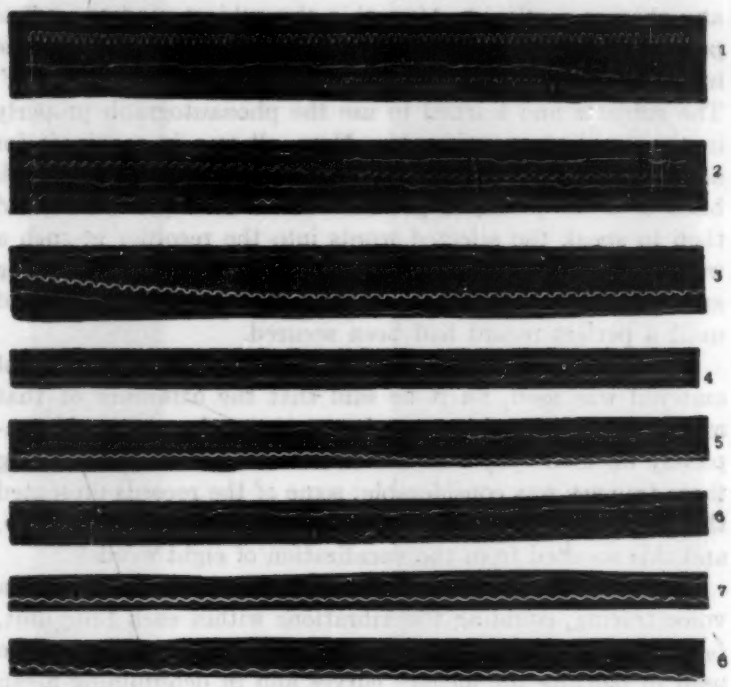


FIG. 1

1=	Female	Subject	No.	2	Vocal	Reproduction	of	Fork	320	d.v.
2=	"	"	"	18	"	"	"	"	"	"
3=	"	"	"	1	"	"	"	"	"	"
4=	"	"	"	15	"	"	"	"	"	"
5=	Male	"	"	7	"	"	"	"	128	"
6=	"	"	"	1	"	"	"	"	"	"
7=	"	"	"	13	"	"	"	"	"	"
8=	"	"	"	12	"	"	"	"	"	"

anything else had done, and one of them, the words, *"Really! You would? Why, Frank, you're quite delightful,"* was defi-

nitely chosen. The effective utterance of this material was found to involve rather pronounced steps and slides in pitch.

Each subject was instructed to read the entire poem silently and to ask the experimenter for the explanation of any obscure portions. After this, the subject read the whole poem aloud to the experimenter endeavoring to follow the instructions: "Put all the feeling you can into your rendition." The subjects had learned to use the phonautograph properly in the previous experiments. Now, all was in readiness for actually making the record. The subject was asked to look back over the poem, to get the context clearly in mind, and then to speak the selected words into the recorder in such a way as to express all possible meaning. Unless a given tracing appeared to be mechanically perfect, the process was repeated until a perfect record had been secured.

Lest some one may wonder why such a small amount of material was used, let it be said that the utterance of that much, with the machine running at the optimum speed, completely filled the paper on the drum. The work of analyzing these tracings was considerable; some of the records presented the problem of counting not less than 20 feet of vibrations, and this resulted from the vocalization of eight words!

The analysis consisted in starting at the beginning of a voice tracing, counting the vibrations within each time unit, ($\frac{1}{10}$ second), and tabulating these numbers as the data to be used in plotting the melody curves and in determining mean pitch, pitch span, etc. So far the procedure tallied closely with that used by Scripture, Merry, et al.

At first approach, the graphic representation of vocal melody seems to be a relatively simple matter. However, one does not get far before meeting with unsuspected intricacies and complexities. All of the melody curves in Scripture's two books are plotted on ordinary squared paper; time units are laid off on the horizontal base line, and equal steps on the vertical line represent the different pitch levels touched by the voice. Scripture neither explains nor attempts to justify his method.

Portions of Two Typical Phonautographic Voice Tracings

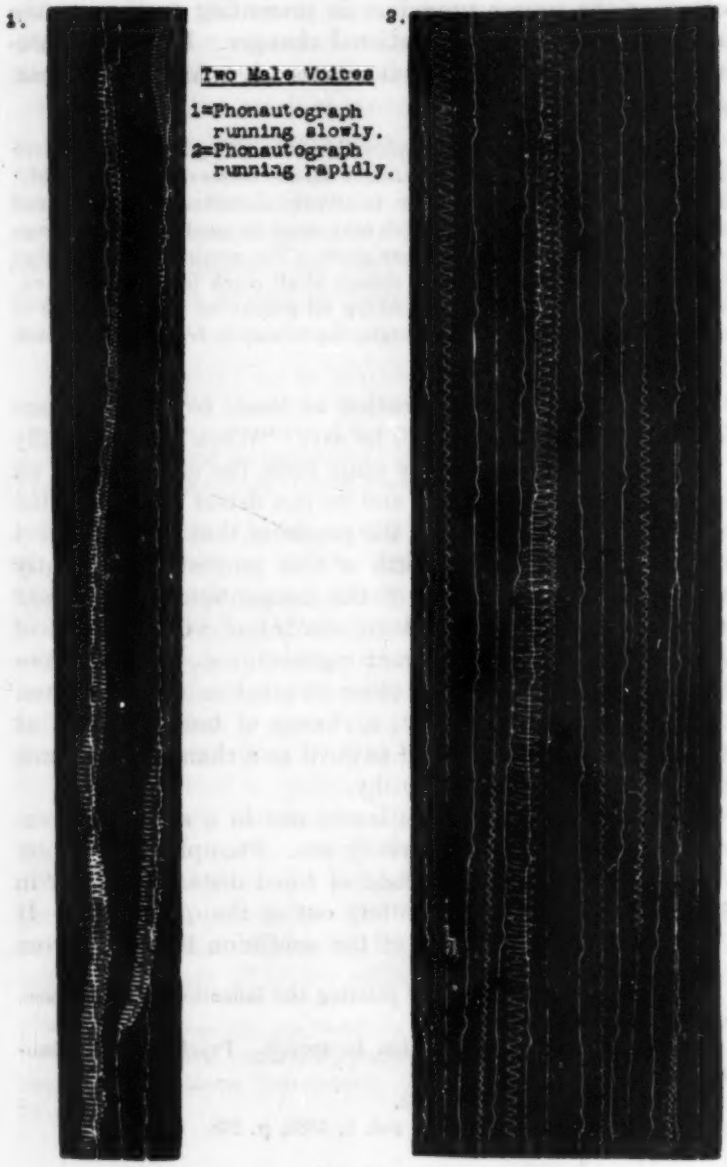


FIG. 2

Bradley[15] and Merry[16] argue for the use of the musical octave as the proper procedure in presenting to the eye the auditory experience of inflectional changes. Bradley's statement of the case is somewhat obscure, but Merry's is clear. Merry says:

> Various methods have been employed in attempting to represent pitch changes in speech. If we represent the data in terms of vibrations only, the facts as experienced will be relatively distorted because a small number of vibrations at a low pitch may mean as much in tonal perception as a large number at a higher pitch. The musical staff furnishes the truest proportions of pitch change at all pitch levels. We have, therefore, adopted the plan of making all graphs on paper in units of semitones, designating in the margin the vibration frequency for each semitone.

Seashore seems, by implication at least, to take substantially the same position when he says: "When conventionally a man and a woman sing the same note, the woman sings an octave higher than the man, and we can detect an error in the woman's singing with twice the precision that we can detect it in the man's."[17] The truth of this proposition evidently rests upon the correctness of the assumption that the ear recognizes a change of a given number of vibrations as of different magnitudes in different registers; e.g., a change from 150 to 160 d.v. would seem twice as great as a change from 300 to 310 d.v. Conversely, a change of ten vibrations at 300 d.v. would seem only half as great as a change of the same number of vibrations at 150 d.v.

A perusal of the literature leaves one in a state of uncertainty as to what the facts really are. Stumpf is quoted by Watt as asserting that the field of tonal distance is one "in which clear results are absolutely out of the question."[18] It is quite obvious that much of the confusion has come from

[15] C. B. Bradley, A method of plotting the inflections of the voice. Science, 1916, 44, pp. 3–5.

[16] G. N. Merry, Voice inflection in speech. Psychological Monographs, xxxi, no. 1, p. 214.

[17] C. E. Seashore, op. cit., p. 72.

[18] C. Stumpf, Tonpsychologie, vol. 1, 1883, p. 248.

the temptation to assume that the mathematics of the musical scale may be laid down in the mind as adequately descriptive of the perception of sound. The physics and mathematics of pitch must not be substituted for the psychology of pitch.

Watt[19] says that much of the unclearness in the psychology of sound arises from the confusion of two concepts, one of which he calls "interval," and the other, "distance." He contends that the octave is essentially and constantly an "interval," established solely upon the basis of the phenomenon of tonal fusion. He says: "the octave as a difference in pitches is not by any means equal throughout the musical range." Again:

> We must be careful not to be misled by the constancy of physical ratios. How do we know that one ratio offers the same possibility of distance in the various parts of the range of pitches? . . . . The only proper basis for the judgment of distances is distance itself. . . . The differential threshold of pitch does not conform to Weber's law.

In support of this contention Watt cites the results of Stuecker's tests[20] as to the differential threshold of pitch. The subjects were 30 professional musicians. Similar material from Meyer, Dunlap, et al. is mentioned.

To add to our difficulty, while it may be relatively easy to determine liminal differences at various points on the scale, the problem is not so simple where the pitch distance is decidedly greater than liminal. This is the case with the distances involved in plotting vocal melody curves. It was demonstrated by Merkel, working in Wundt's laboratory, that the differences for which Weber's law is valid are liminal, and that the addition of a constant amount of stimulation beyond this just perceptible difference seems the same at any point in the scale. Then too, the variable time factor in vocal expression upsets all of our calculations as to the correct psy-

[19] H. J. Watt, op. cit., pp. 75–82.

[20] N. S. Stuecker, Ueber die Unterschiedsempfindlichkeit fur Tonhoehen in Verschiedenen Tonregionen. Zetschr. Sinnesphysiol., 1908, 42, pp. 392–408.

chological measure of pitch changes. Scripture calls attention to the disturbing element of time in inflection. He cites Marten's experiment with the falling pitch of a siren. The tone was dropped at different rates and it was found that the number of different pitches which could be detected by trained musical ears is a function of the rate of change.[21] In another connection Scripture says: "Owing to inaccuracies in sensation, sounds in close succession may differ without the difference being perceived."[22]

From what has been said, it is apparent that the graphic representation of vocal inflection presents problems which seem to baffle solution. If we accept Stuecker's findings, and if we assume that pitch distance at different points on the scale is determined by the threshold at these points, it then seems probable that Scripture's method of plotting melody curves is more accurately representative of the facts of auditory perception than is a method which reduces the distance by one-half for each octave of rise in pitch. It is to be noted, however, that Stuecker did find some increase in liminal distance as we go up the scale within the range of the voice in speech, if we include both the male and the female voice. The threshold was determined as 0.4 at 70, 125, and 250 d.v.; 0.65 at 417 d.v.; and 0.9 at 834 d.v.

After plotting all of the data on ordinary squared paper, it was finally decided to use semi-logarithmic graph paper. Whether the melody curves thus plotted give an absolutely accurate picture of the facts of auditory perception or not, the method is very convenient, it is probably as accurate as any other method, and it is a compromise between the two other methods which have been used most generally. At least it furnishes an apparently invulnerable basis for the principal conclusions which are to be drawn from the data here presented.

After the vibrations within each $\frac{1}{10}$ second had been counted and tabulated, the measures were graphed on the semi-logarith-

[21] E. W. Scripture, Elements of Experimental Phonetics, p. 473.
[22] Ibid., p. 199.

mic paper; the units on the base line being $\frac{1}{20}$ second and the units on the vertical axis being 1 d.v. The curves were plotted without any smoothing. In connection with this matter, Merry concluded that he should plot his raw readings without smoothing. His reason seems valid. He says:

> . . . . the true contour of a curve would perhaps be more nearly right if it were smoothed in accordance with conventional methods of smoothing. The merit of the method adopted is that it shows the actual, individual readings and enables any interpreter or future experimenter to decide what type of smoothing should take place.[23]

Herewith are included eight typical melody curves; four of the women subjects' and four of the men's.

When the curves had all been plotted, it was felt that it was necessary to establish some simple numerical index for the amount of inflectional change in a curve. The object was to develop some suitable common measure which would make possible to comparative study of the inflectional patterns of different individuals and of the two groups of subjects.

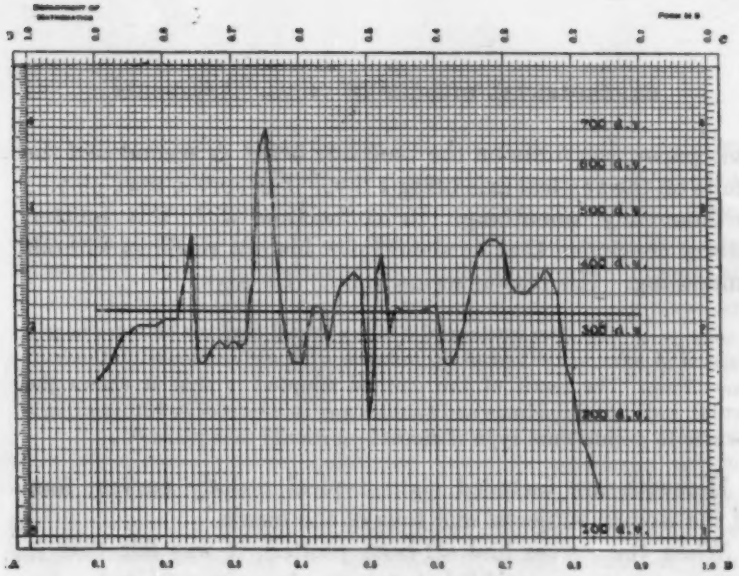
The graphs did not indicate the pauses in speaking; they show merely the rise and fall of pitch during actual vocalization. It seems rather reasonable to suppose that the number and the length of the pauses may not be unimportant in conditioning the perception of melody, but, not knowing how to appraise this factor, it was thought best to ignore it altogether.

The time consumed in the actual vocalization varied greatly among the subjects. Table 3 shows the length of the curves for the 42 subjects. The averages for the two columns indicate the women exceed the men by nearly 30 per cent in the amount of time used in vocalizing the same language. If, as seems probable, the effectiveness of inflectional change is in inverse ratio to the speed with which it occurs, then the decided advantage would be with the slower utterance of the women subjects.

It was at first thought that the most useful index of inflection might be the *range* or *span* between the lowest and the

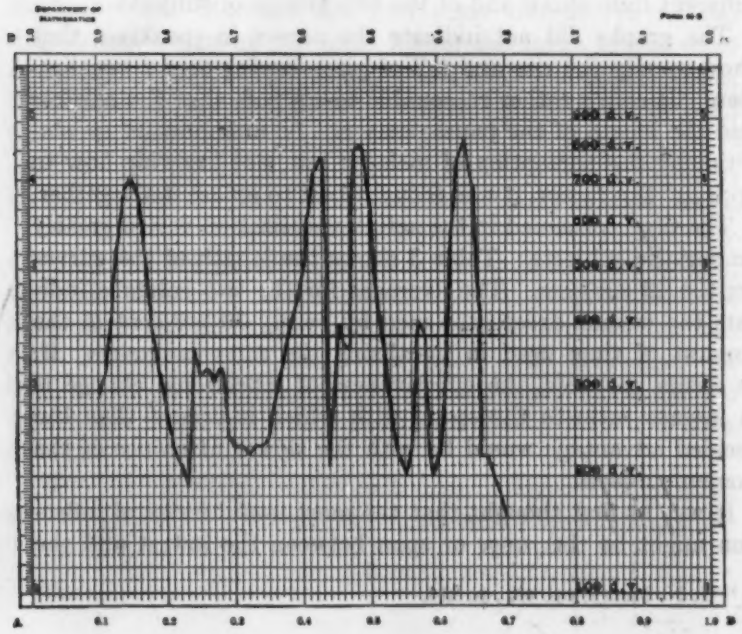
[23] G. N. Merry, op. cit., p. 214.

I



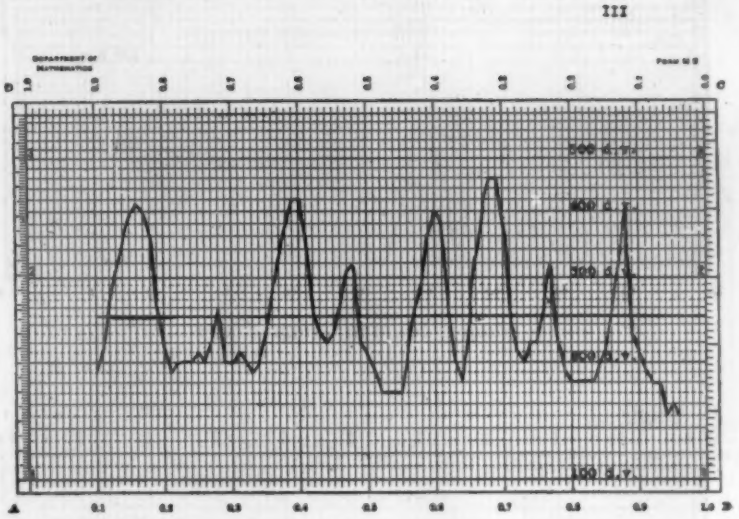
Subject No. 2 in Group of Women

II

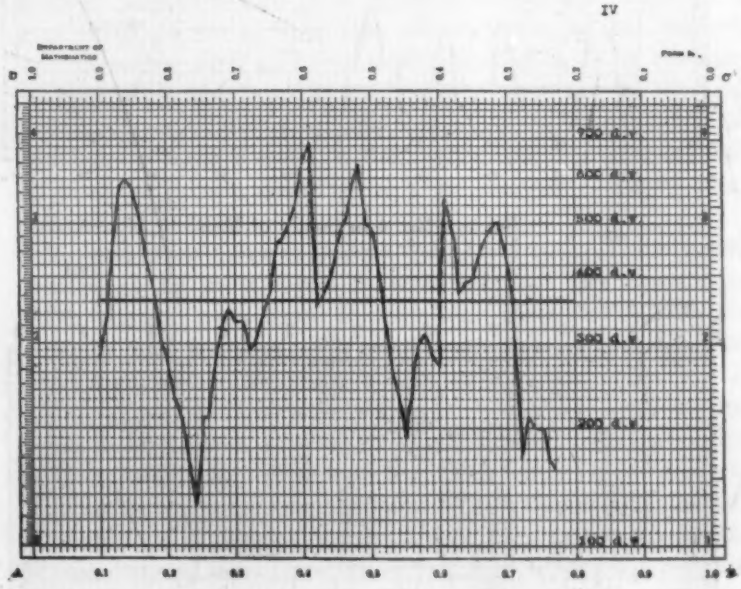


Subject No. 5 in Group of Women

FIG. 3



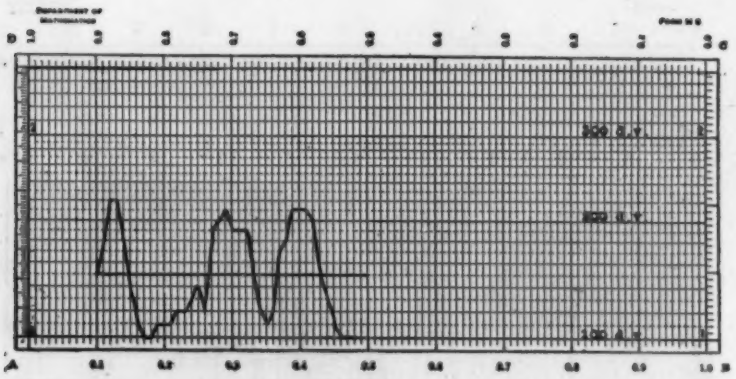
Subject No. 7 in Group of Women



Subject No. 11 in Group of Women

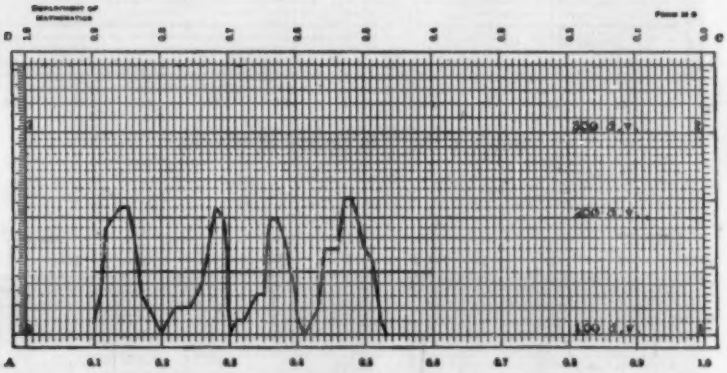
FIG. 3 (continued)

V



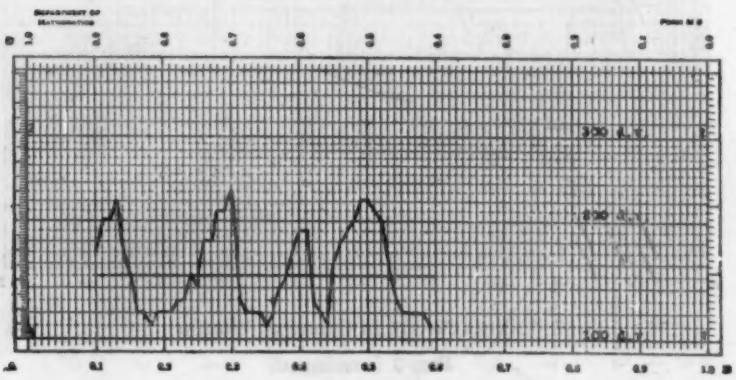
Subject No. 3 in Group of Men

VI



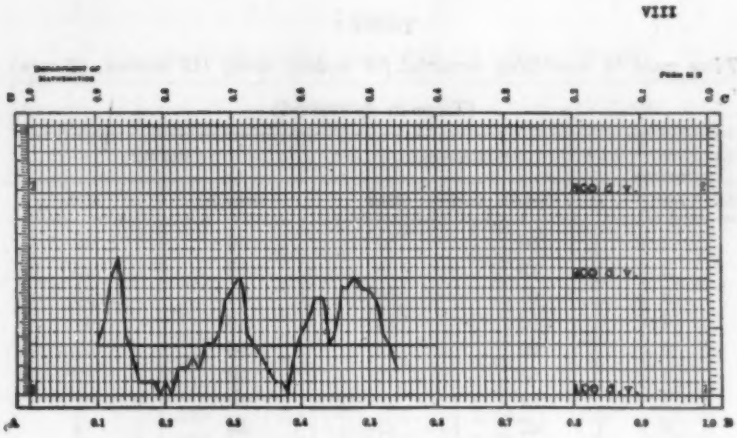
Subject No. 4 in Group of Men

VII



Subject No. 5 in Group of Men

FIG. 3 (continued)



Subject No. 9 in Group of Men

FIG. 3 (continued)

highest pitches shown in a given vocalization. There is a great deal of variation among the subjects in this respect, and of course such an index is commended to us by the ease with which it may be computed. Upon more careful observation, however, it was found that this measure seemed to depend too largely upon chance in the rather freakish rise and fall of pitch in certain cases to be a satisfactory index of total inflectional change.

Several other possible indices were tried out. Those which seemed to be most fairly representative of the amount of pitch change were three in number. First, there was *the index of total deviation*. This was computed by summing the deviations, within the various time units, from the arithmetic mean. This method was used in measuring memory for pitch and vocal pitch control, as explained in the preceding section. Second, there was *the index of total fluctuation*. This index is figured more easily than the former; the number of vibrations of change from one time unit to the succeeding is recorded and the sum of these changes constitutes the index. Third, the one which was finally adopted, was *the curve area* as measured by the planimeter.

TABLE 3

Time used in vocalizing material for melody study (19 women, 23 men)

(Time in $\frac{1}{10}$ second)

SUBJECTS	ACTUAL UTTERANCE		PAUSES	
	Women	Men	Women	Men
1	50	24	14	19
2	73	38	32	13
3	41	40	21	15
4	52	36	26	41
5	60	43	30	15
6	63	47	37	19
7	87	49	32	32
8	47	47	34	4
9	50	50	27	12
10	39	45	29	31
11	67	40	37	19
12	45	30	16	21
13	56	69	17	25
14	34	34	30	17
15	88	36	52	31
16	53	37	40	15
17	65	48	19	45
18	51	49	32	12
19		41		22
20	57	45	15	20
21		82		33
22		37		27
23		42		16
Totals.....	1078	1009	540	504
Means.....	56.73	43.87	28.42	21.9
A.D.....	10	8.04	7.62	8.54
$P.E._M$.....	1.93	1.4		
D.....	12.86			
$P.E._D$.....	2.38			

$\frac{D}{P.E._D} = 5.4$; coefficient of reliability = 0.99986*

* E. L. Thorndike, op. cit., p. 200.

TABLE 4

Amount of inflectional modulation (19 women, 23 men)

SUBJECTS	WOMEN				MEN	
	Pitch span	Total Deviation	Total Fluctuation	Curve area	Pitch span	Curve area
	d.v.	*d.v.*	*d.v.*	*square inch*	*d.v.*	*square inch*
1	250	118	78	1.37	260	1.13
2	570	245	144	2.84	160	1.38
3	400	219	122	2.20	120	1.48
4	350	197	140	2.19	120	1.43
5	680	482	273	5.15	120	1.59
6	370	339	134	4.06	60	0.88
7	320	297	154	4.25	90	0.78
8	340	172	105	2.44	170	2.78
9	350	184	114	2.25	120	1.37
10	330	148	92	1.72	80	0.91
11	560	385	196	4.53	290	5.70
12	200	100	63	1.19	100	0.96
13	330	185	123	2.18	130	1.33
14	220	108	62	1.21	90	0.79
15	440	316	185	4.10	250	2.18
16	530	214	134	2.39	100	1.05
17	460	244	146	3.20	140	1.69
18	280	144	87	1.75	150	1.10
19					170	0.68
20	420	225	96	2.74	100	1.40
21					100	1.25
22					60	0.93
23					90	0.73
Totals.....	7400	4322	2448	51.76	3070	33.53
Means.....	389.47	227.47	128.84	2.72	133.47	1.45
A.D.....	99.39			0.9547	45.41	0.5765
P.E.$_M$.....	19.08			0.180	8.01	0.101

Reliability of difference between pitch span for men and that for women: $\frac{D}{\text{P.E.}_D} = 12.37$.

Reliability of difference between melody curve area for men and that for women: $\frac{D}{\text{P.E.}_D} = 6.35$.

When the melody has been plotted on semi-logarithmic paper, the curve area takes into account the reduction of pitch distance as the pitch level rises. This index corresponded very closely with the other two and is much more easily ob-

TABLE 5

Average pitch of male and female voices (19 women, 23 men)

SUBJECTS	WOMEN	MEN
	d.v.	d.v.
1	300	320*
2	320	140
3	400*	150
4	360	150
5	380	150
6	340	110
7	250*	130
8	270	140
9	300	140
10	300	110
11	370	210
12	320	140
13	300	170
14	320	150
15	280	200
16	320	140
17	300	130
18	300	140
19		220
20	320	120
21		120
22		100*
23		110
Totals	6050	3490
Means	318.42	151.73

* Highest or lowest.

tained. Table 4 shows the pitch span, the total deviation, the total fluctuation, and the melody curve area for the 19 women; the pitch span and the melody curve area for the 23 men. Table 5 shows the average pitch of the male and female voices

as computed from the data. In all of the tables, the subjects are arranged in the same order.

An examination of the data contained in tables 4 and 5, reveals some interesting sex differences in average vocal pitch and in amount of inflectional modulation. The figures in table 5 were obtained by adding the number of vibrations within the time units of the record and dividing by the number of units. The measures in each column, marked with asterisks, are the highest and lowest for the male and females voices. With the exception of the first subject among the men, the pitch registers of the two groups are mutually exclusive. The first subject in the second group had a voice of shrill falsetto pitch which was easily recognized as effeminate. The mean pitch of the male voices is 151 d.v.; that of the female voices is 318 d.v. This tallies accurately with the general impression that the average female voice is approximately one octave higher in pitch than the average male voice.

Table 4 shows how the male and the female voices compare as to the amount of inflectional modulation. The average area of the melody curves, as measured by the planimeter, is 1.4578 square inches for the men, and 2.7242 square inches for the women. Great as is this difference, it has been much reduced by plotting the curves on the semi-logarithmic paper. If the ordinary squared paper had been used, the advantage in favor of the female voices would have been just about doubled. It will be observed that the difference in the amount of inflection shown by the men and by the women is very reliable; 6.35 times its probable error.

It is true, of course, that curve area is somewhat dependent upon the rate of utterance, and we have noted that the women subjects spoke considerably more slowly than the men did (table 3). The difference in this respect is not great enough to account for the difference in curve area, and it is not to be forgotten that, since the index is to symbolize the effect of the inflection upon the ear, this very reduction in the rate of utterance which makes for an increased curve area doubtless also increases the effectiveness of the inflectional change.

The measures of pitch span show that the average female voice has a pitch span of 389.47 d.v., while the male voice has but 133.47 d.v. Again we find a marked difference in favor of the female voice, the span of which is nearly three times the span of the male voice. The difference in this case is more than twelve times the size of its probable error.

What these differences may mean with respect to effectiveness in vocal expression is yet to be determined. Woolbert, in his study of methods in reading,[24] found that the most effective reading, as determined by the criterion of retention on the part of listeners, involved relatively large amounts of pitch change. His conclusion is in line with the consensus of opinion among teachers of vocal expression. In the present studies, the results of attempts to demonstrate a relationship between the index of inflection and a group judgment of effectiveness in vocal expression were disappointing. Using the Spearman formula, the coefficient of correlation was found to be +0.15 for the women and +0.28 for the men. The number of cases is so small as to make the coefficients unreliable.

As has been said, there is practical unanimity of opinion among workers in the field of vocal expression that a considerable amount of pitch change is prerequisite to an effective use of the voice. Reasoning a priori, it would seem that the determining factor in the effective use of pitch change must be the appropriateness of its relation to the meaning of the material vocalized. It seems probable that the relationship between the amount of inflection and the degree of effectiveness in vocal expression is a one way relationship. All effective vocal expression involves a large amount of inflectional modulation; of that there seems to be little doubt. But the proposition cannot be converted simply; it is apparently not true that all vocal expression involving a large amount of pitch change is necessarily effective. There are rich possibilities yet untouched in this field.

[24] C. H. Woolbert, Effects of various modes of reading. Journal of Applied Psychology, September 1920, pp. 162–185.

It may be interesting to compare the pitch span of the subjects in these experiments with that of some of the speakers whose phonograph records were studied by Dr. Merry.[25] It is difficult to make any comparisons of the other measures of inflection; in the nature of the case there are too many variables involved. Each of the speakers in Dr. Merry's list was uttering material different from that uttered by the others. E. H. Sothern was reading the lines of Shylock in the court room scene from *The Merchant of Venice*. Julia Marlowe was reading Portia's speech in the same scene. The others were delivering popular addresses. The pitch span of the several speakers will be shown in table 6.

TABLE 6

Pitch span of readers and speakers

(Dr. G. N. Merry's studies)

SUBJECTS	LOWEST PITCH	HIGHEST PITCH	SPAN
	d.v.	d.v.	d.v.
W. G. McAdoo	100	210	110
James Gerard	120	240	120
Franklin Roosevelt	100	256	156
Rabbi Stephen Wise	80	200	120
E. H. Sothern	100	390	290
Corinne Robinson	110	385	275
Julia Marlowe	190	430	240

Average span for men = 158.2 d.v.
Average span for women = 257.5 d.v.

Comparison of these figures with those shown in table 4, indicates that the 5 men studied by Mr. Merry have a pitch span slightly greater than the average for my second group, 158.2 d.v. as against 133.47 d.v.; while the average for the 2 women is 257.5 d.v. as compared with an average of 389.47 d.v. for my subjects. Of course the nature of the material which the several speakers were expressing vocally is so variable that no definite conclusions are to be drawn from this data.

[25] G. N. Merry op. cit.

A MENTAL PROFILE FROM AN OMNIBUS GROUP TEST

JOHN J. B. MORGAN

State University of Iowa

In answer to the demand for simplicity in administration the omnibus test has come into existence. That it has obvious advantages no one questions. It eliminates the distasteful *stop—start* situations which some individuals report to be so disagreeable that they cannot do good work in the tests. It prevents all possibility of changes in the directions because these are incorporated in the test itself. It excludes the possibility of the examiner making a slip in his time checks. It is as near "fool-proof" as any testing method yet evolved.

This change toward simplicity of administration has been accomplished at no cost in reliability. For example, the Morgan Mental Test correlates 0.85 with individual examinations by the Stanford-Binet Scale. Its internal reliability is about 0.98. There is however one element that has been of a decided disadvantage. This is the fact that the different performances are combined in such a way that the total score tells nothing as to any particular outstanding ability or lack. While the achievement on the different tests in such an examination as the Alpha has not led to any widespread differentiation in use, there has existed the possibility of quickly determining whether the person was weakest in ability to follow directions, in the perception of relations, in information, etc. This is not true in the ordinary omnibus test. One must search through the test to determine any outstanding lack or ability.

This objection has been met in a profile devised in connection with an examination conducted at the Palmer School of Chiropractic at Davenport by the writer.

The standardization of the Morgan Mental Test has been so conducted that the items are arranged very closely in the order of difficulty from the extremely easy problem to the superior adult problem. The time allowed for the whole examination is so long that all individuals, except the superior ones, reach the level of their ability before the expiration of the time limit. This makes it largely an ability test and with the ordinary individual the point between achievement and failure is fairly sharply defined. This gradation of problems according to difficulty is a primary requisite if the profile to be described is to be of any value. Not only must the final scores be standardized but the value of each item carefully determined and its position in the test decided accordingly.

Three tests were given in this examination: First, the Morgan Mental Test; second, the word building test; and third, a test of memory span for digits. All these were included in the record which was returned for each examinee on a record-card, a sample of which is herewith given.

The problems in the Morgan Mental Test were divided into seven general groups and these were named in such a way as to be of the maximum practical value rather than in any attempt at absolute accuracy in terminology. Any such naming is bound to be defective due to the complications involved in any one type of performance; but the name in conjunction with a knowledge of the concrete performance for which the name stands is valuable.

These groups were as follows:

1. Reasoning. This includes arithmetical reasoning in the lower ranges and a modified superior adult ingenuity problem in the higher ranges with intermediate problems of logical reasoning.

2. Imagination. The simpler problems included under this caption are questions of discrimination ending with an adaptation of the Binet paper cutting test.

3. Adaptability. This series is made up entirely of mixed letters to be incorporated into a suitable word. These are solved by a trial and error method. The subject thinks of

one article of men's clothing and compares it with the letters; then chooses another at random and compares it with the letters. This is continued until the proper name is found.

It has been found that the greatest handicap in the performance of this type of problem is the fact that one gets an apperceptive arrangement which persists in spite of evidence that it is incorrect. The adaptable person is the one who can quickly dismiss a wrong combination and search for another. For instance, when asked to rearrange the letters D O R O F S X many individuals think immediately of sox or odor and then try to get some modification of these. If such a suggestion persists the solution is hopeless. In other words the good forgetter can solve such a problem much more readily than the one who so falls in love with his first guess that he cannot rid himself of it.

4. Guessing ability. All the tests in this series are the familiar completion tests. By guessing we mean the ability to use faint clues to arrive at a decision as to the proper word. The parts of the sentence that are given furnish more or less obscure suggestions as to the meaning, the successful subject acts immediately on these suggestions. Guessing is not chance, it is the use of intangible bits of evidence and this is the main feature of the completion test.

5. Analytical ability. This comprises a series of number-series-completion tests.

6. Versatility. The type of problem used in this series is illustrated by the following question: "What six coins add up to ten cents?" The elements in such a problem are very familiar. The way in which they must be manipulated is relatively new. The versatile man is the one who can adapt old elements for use in a new situation.

7. Perception of relations. The tests in this group comprise a series of mixed relations.

8. Vocabulary. Under this caption was recorded the score in the word building test.

9. Memory span. Auditory memory span for digits.

The record card used to report the results of this survey has at the extreme left a column of Mental Age Equivalents. The next seven columns have numbers indicating the different items in the Morgan Mental Test. The position of the numbers opposite the Mental Age Equivalents indicate the relative difficulty of each item. The value of different performances in the Word Building and Memory Span is shown in the same manner. Finally the Total Morgan Test Scores are arranged according to Mental Age Equivalents.

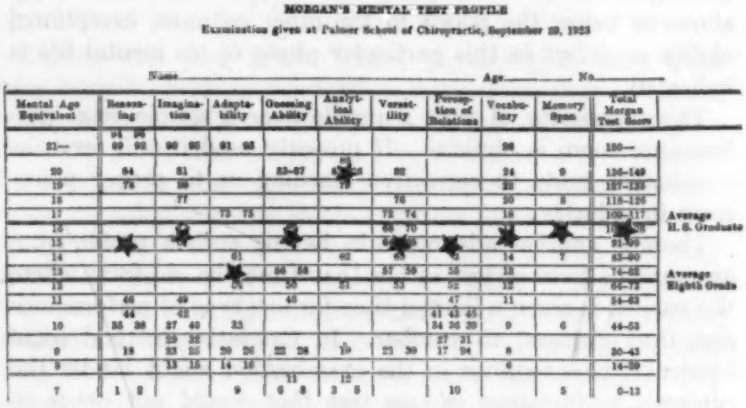


FIG. 1

The recording of a performance on this card is very simple:

1. Go in order through the test paper and cross off on the card the numbers corresponding to every question incorrectly answered or omitted.

2. With a rubber stamp in the shape of a star indicate the point midway between the highest correct performance and the lowest failure in each column.

3. If the tests passed in any column do not give an unbroken series, lower the point to be stamped by one test for each test failed. For example, suppose in adaptability the subject passes questions 9, 14, 16, 26, 33 and 54; and fails to do correctly tests 20, 61, 73, 75, 91 and 93. If it had not been for

the failure in test 20 the star would have been midway between 54 and 61 giving the equivalent of the mental age of 13. Since he failed number 20 the star is lowered to the point between 33 and 54 or a mental age equivalent of 11.

To be sure, the stars thus placed are not intended to give a reliable mental age in each ability represented, but to show the relative excellence of the subject in the different processes. If the line connecting these stars is a horizontal line the individual has no exceptional abilities so far as they are included in these tests. If in some particular column the star is markedly above or below the points in the other columns, exceptional ability or defect in this particular phase of his mental life is indicated.

The superiority of such a profile over a simple total performance score is obvious. If properly used it will serve as a valuable guide to corrective teaching or to proper placement in industry.

There is another advantage in having such a profile from an omnibus form of test rather than from the old form where the subject is given a limited time for one type of performance and then changed to another. In the latter method some incidental circumstance in the examination might hinder the subject's performance in one test that would not occur in another. The irregularity in the profile would then be the result of incidental factors in the examination situation rather than the picture of the ability of the subject. In the omnibus form the subject is continually shifting from one type of operation to another and the fact that one type of problem is consistently failed and another correctly solved is evidence of ability rather than of an accidental product of the test situation.

TEMPERAMENT AND MENTALITY IN MATURITY, SEX AND RACE[1]

S. D. PORTEUS

Director of Research, Psychological Laboratory, The Training School at Vineland, N. J.; Professor of Clinical Psychology, University of Hawaii

During the past fifteen years, psychologists have been very busy in devising intelligence tests—tests that is to say, which attempt to measure inborn mental capacity. Up to a certain point their efforts have been comparatively successful so that we now have fairly reliable measures of the all-round capacity of young children; rather less reliable measures of the capacity of individuals in early adolescence; and very unreliable measures of the capacity of adults. As a result of this work certain psychologists have made some surprising statements. The first is that no very significant mental differences are discernible between males and females. The assumption has been made that the differences in achievement of men and women are not due to innate differences in the sexes but merely to inequalities of opportunity and training.

A second, even more surprising discovery is that no significant mental development is discernible in the individual after about fifteen years of age—learning capacity having reached its peak of efficiency by this age. In accordance with this it has been pointed out that the psychologists who carried out the army examinations in the late war found that the average mental age of the enlisted men was only about 13.8 years. The vice-president of the Psychological Section of the American Association for the Advancement of Science,

[1] An address given to the Clinical Society of Surgeons at Wistar Institute of Anatomy, Philadelphia, Pennsylvania, November 16, 1923.

in his retiring address[2] said, "It is a fact then that average scores of intelligence tests do not advance significantly after the age of fourteen years or thereabouts." He appears to consider this conclusion to be in agreement with the facts of growth in general, stating that the organism arrives at approximate maturity of growth in stature and in many other physical traits in early adolescence and that the test scores indicate also the maturing at about the same time of intelligence as measured by mental tests.

A third remarkable discovery is that race, too, is an insignificant factor in mental development. Japanese, Chinese, and American children educated together in American schools reach approximately the same scores in intelligence tests. The assumption has been made that differences in racial achievement are also due, not to innate differences in the races concerned, but to inequalities of opportunity. While it is true that differences in the racial average have been found between children of American stock and those of the southern European races such as the Italian and Portuguese, yet if the Orientals can be brought by better education up to the American level, it does not seem unlikely that the same thing can be done with the southern European peoples. Even the observed differences between the American negro and the white children are attributed by certain anthropologists as being due, in the main, to the environmental disadvantages of the former.

Accordingly we may summarize these remarkable conclusions as follows:

There are no significant mental differences between males and females. There are no significant mental differences between the average fourteen-year old boy and the average man. There are no significant mental differences between the races.

[2] Guy M. Whipple, The intelligence testing program and its objectors, conscientious and otherwise. Reprinted from School and Society, vol. XVII, no. 440, May 26, 1923; vol. XVII, no. 441, June, 1923.

Undoubtedly the studies from which these conclusions are drawn may be, as far as they go, careful and reliable, but the conclusions themselves may be at the same time too sweeping and only partially justified.

These conclusions are astonishing for the simple reason that they run counter to everything that commonsense observation tells us of the importance of sex, maturity and race. In this day and age of intellectual freedom and opportunity it seems strange to ascribe the difference in achievement of the two sexes merely to environmental facts. It is equally difficult to believe that the differences in progress made during the last fifty years by the Japanese and Chinese are not due to actual differences in the racial intelligence of the two peoples. It seems much more reasonable to believe that the Japanese and the Chinese and the American people have just about the religion and the government and the scientific and industrial status that they deserve to have. With regard to the statement that there is no significant growth in intelligence after fourteen years[3] and that the "mental age" of the American nation on the average is that of a child of fourteen years, I believe that we should demand the fullest proof before we accept statements such as these that run so contrary to everyday experience. Maybe the psychologist is like the man who went fishing and because he could not catch a fish came home with the firm belief that there were none to catch. The fact that the psychologist has not discovered any of the mental differences associated with sex, maturity and race, does not

[3] The weakness of the argument for the early cessation of mental growth is well stated by the late Prof. J. A. Green (Jour. Exper. Ped., December, 1922). "The fact that mental tests necessarily adapted to a puerile world do not bring out superior intelligence of older people is not a proof that intelligence ceases to grow at fourteen. If our thermometers measure temperature up to only 100°, it would be obviously absurd to say that temperatures did not rise higher." There are also some psychologists who have duly emphasized the importance in mental measurements of factors due to sex and race. Cf. Yerkes, Bridges, Hardwick, A point Scale for Measuring Mental Ability, Chapters 6 and 7.

by any means prove that none exist. My object in this paper is to report some of the results that I have obtained in the search for these differences.

Taking the greatest heresy against commonsense first, there is no significant growth of intelligence from early adolescence to maturity, we may remark that the facts regarding physical maturity do not by any means back up this conclusion, at least in respect to the most important growth of all—brain development.

For the past eight years I have carried on studies on brain capacity as calculated from the three head measurements—the maximum antero-posterior length, maximum breadth and auriculo-bregmatic height. The formula for calculating the capacity was worked out by Dr. Alice Lee in Karl Pearson's laboratory in London. Testing this formula on the heads of subjects in the dissecting room at the Anatomy Department of the University of Melbourne, Dr. Anderson found that it gave the capacity within a 6 per cent average error. In collaboration with Dr. Berry, Professor of Anatomy at the same University, I measured the heads and calculated the brain capacity by Lee's formula of some thousands of individuals of all ages from six years to maturity and have published the figures of brain growth for each year upon which figure 1 is founded.[4] So far from brain growth being complete at fifteen years in the male it will be seen that it continues right on to a period between twenty and thirty years of age. If mental growth ceases at fifteen years of age then this additional brain growth has no connection with the growth of intelligence. This is a most unlikely assumption. In order to show the significance of brain capacity I have marked on the graph the average brain volume of a group of university students representing the educated class; a group of indigent adults representing the comparatively socially inefficient; a group of blind representing those in whom brain growth has been

[4] R. J. A. Berry and S. D. Porteus, Intelligence and social valuation. Research Publication No. 20, Training School, Vineland.

hindered by sense deprivation; a group of Australian aborigi-nals representing a race in whom brain growth has remained at a low level because of the lack of stimulus in their simplified environment; and finally a group of adult feebleminded—all males.

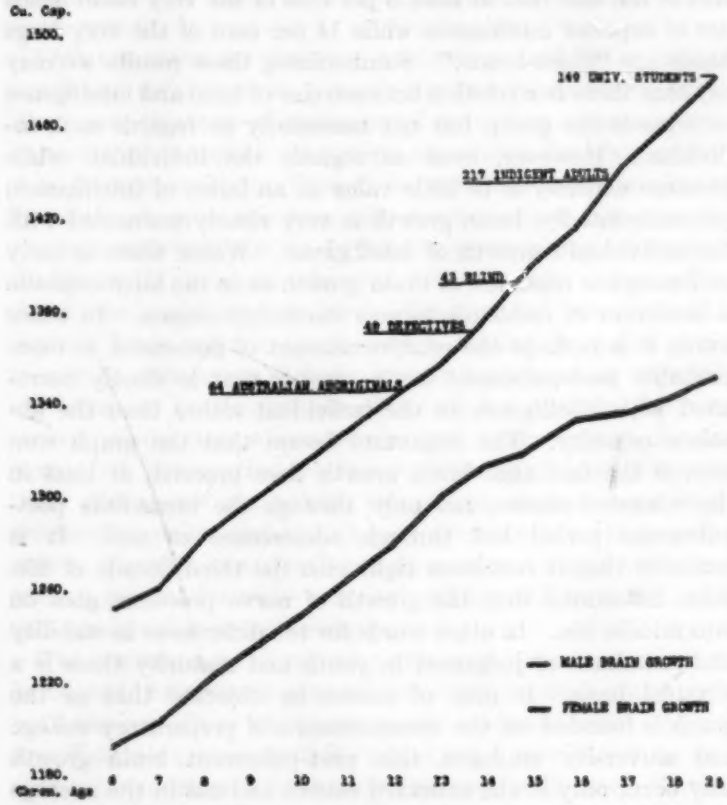


FIG. 1. MALE AND FEMALE BRAIN GROWTH IN ANGLO-SAXONS

The relation of brain capacity to intelligence has been shown in another way. I examined by mental tests a group of 200 cases in the extremes of brain size. The relation to intelli-gence is obscured because there are both large headed and

small headed feebleminded but the fact remains that there are four times as many feebleminded among the small heads as among the large heads and on the other hand five times as many of superior intelligence among the large heads as among the small heads. However, the microcephalic can take comfort in the fact that at least 5 per cent of the very small heads are of superior intelligence while 14 per cent of the very large heads are "block-heads." Summarizing these results we may say that there is a relation between size of head and intelligence as regards the group but not necessarily as regards each individual. However, even as regards the individual, while absolute capacity is of little value as an index of intelligence, yet undoubtedly, brain growth is very closely connected with the individual's growth of intelligence. Where there is early and complete cessation of brain growth as in the microcephalic a condition of feeblemindedness inevitably ensues. In other words it is perhaps the relative amount of post-natal or more probably post-pubescent brain growth that is closely correlated with intelligence in the individual rather than the absolute capacity. The important lesson that the graph conveys is the fact that brain growth does proceed, at least in the educated classes, not only through the immediate post-pubescent period but through adolescence as well. It is probable that it continues right into the third decade of life. Kaes has stated that the growth of nerve processes goes on into middle life. In other words for the differences in stability and soundness of judgment in youth and maturity there is a physical basis. It may of course be objected that as the graph is founded on the measurements of preparatory college and university students, this post-pubescent brain growth may occur only in the educated classes and not in the average population. However, there is every indication that this is not the case. Measurements of over 4000 cases of average social grade showed that brain growth proceeded parallel to that of better social grade though at a lower level and there was no sign of any diminution of growth at fourteen years where our measurements of this group ceased. The fact that

the indigent adults reached as close to the university students as they did, is additional evidence that brain growth does not cease in the lower social grades at fourteen years. The common-sense view point that there are very significant differences in the intelligence of the average individual at fourteen years and twenty-five years has ample support from the facts of brain growth.

This brings us to the next contention that there are no significant differences in mental capacity between the sexes. Here again the facts of brain growth as well as common sense, contradict the theory. The graph also shows the brain growth of males and females. That of the female is less than that of the male at each age from six years onward but roughly parallels male growth up to fifteen years of age—thence it diminishes in rate considerably and virtually ceases at or about the eighteen-year level. It may be true that this lessened brain capacity in females is related in earlier youth merely to differences in body growth in general as reflected, for instance, in stature but this will not explain the very serious diminution of post-pubescent brain growth in the female. I believe that to this superiority of post-pubescent brain growth we can ascribe the greater average general efficiency of males and that herein also lies the fundamental reason why this is and will remain a man-directed and not a woman-governed world—universal suffrage and woman's rights and coeducation notwithstanding.

The reasons why I consider this post-pubertal growth to be of such importance may be seen from figure 2 which indicates the growth of the layers of the cerebral cortex. Adopting Watson's grouping of the nerve cell layers it will be seen that in comparison with such an animal as the mole there is relatively little difference between the animal and human as regards the two lowermost layers—the granular and infragranular. It is the supragranular layer which is the distinctively human development in the cortex. Through the work of Bolton, Mott and Watson it has been shown that it is this layer which is most deficient in the feebleminded and under-

goes the first and greatest degeneration in chronic dements. This layer evidently subserves learning capacity which is deficient in the feeble-minded. By a statistical study of the feebleminded[5] I have shown that it is not only in learning capacity that the feebleminded are deficient but in certain temperamental traits as well. They tend to lack planning capacity, they are irresolute or impulsive, easily confused, excitable, obtrusive, suggestible and simple. Many of these temperamental deficiencies may be summed up by saying

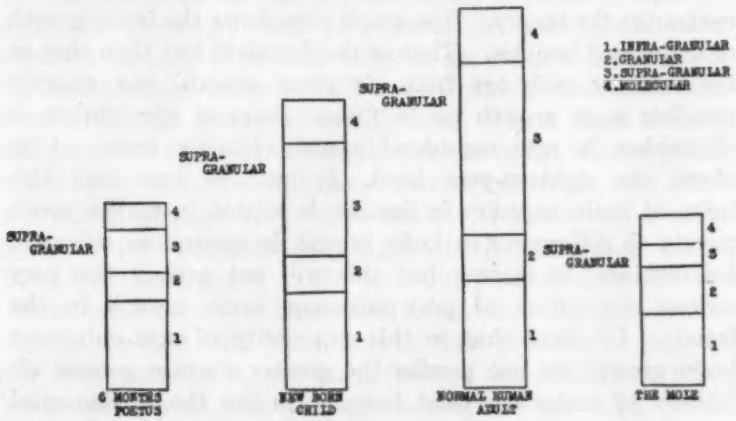


FIG. 2. RELATIVE DEPTH OF CEREBRAL CORTICAL LAYERS
(After G. A. Watson and J. Shaw Bolton)

that they are underinhibited and as this is true also of the demented it is very likely that the integrity and development of the supra-granular layer are essential not only to learning capacity but also to self-control. The diagram also shows that while the other two layers are complete in early childhood it is this most important supra-granular layer that continues to grow. At birth 93 and 82 per cent respectively

[5] S. D. Porteus, Study of the personality of defectives with a social ratings scale. Publication No. 23, Research Dept., Training School, Vineland.

of the two lower layers are complete while the supra-granular layer has only 60 per cent of its adult depth. The assumption is that it is the supra-granular layer which is completing its development after puberty. The greater nervousness, impulsiveness and lessened emotional control in women may possibly be ascribed to lessened supra-granular growth. As regards the efficiency of the individual the later the growth the more important it is.

Turning now to the problems of race we can also find evidence for a physical basis of observed differences. During my two years tenure of the chair of Clinical Psychology in the University of Hawaii, I have measured some 5000 heads and I am presenting results for the Oriental races in figure 3. It will be seen that the Japanese children at six years are practically on the same mark as the Anglo-Saxon and that they continue to roughly parallel the white race in brain growth up to the point where my measurements ceased—the sixteenth year. There is, however, a slight tendency of the Anglo-Saxon superiority to increase with age. The differences may be in part ascribed to the lessened bodily size and stature of the Japanese but if this is a factor then the inferiority of the Chinese to the Japanese at every age is much more striking because the former are the taller race. I cannot help but believe in the importance of these differences in average brain development and in them, to my mind, lies one of the chief reasons why Japan and not China is a great world power today. The Japanese are racially more intelligent. These results are confirmed by a comparison of the female brain capacity where the three races occupy the same relative positions.

We may now turn to the quest of the mental correlates of these physical differences. It is true as previously stated that in learning capacity there are no significant differences between the male and female, between the early adolescent and the adult, and between one civilized race and another. The American girl learns, if anything better than the boy; the boy learns, if anything, more readily than the adult;

the Chinese more readily than the Japanese. But it is in their adaptation to life's situations that the man excels the woman, the adult the boy, the Japanese the Chinese.

The capacity for all-round adjustment has been made the basis of the most commonly quoted definition of intelligence

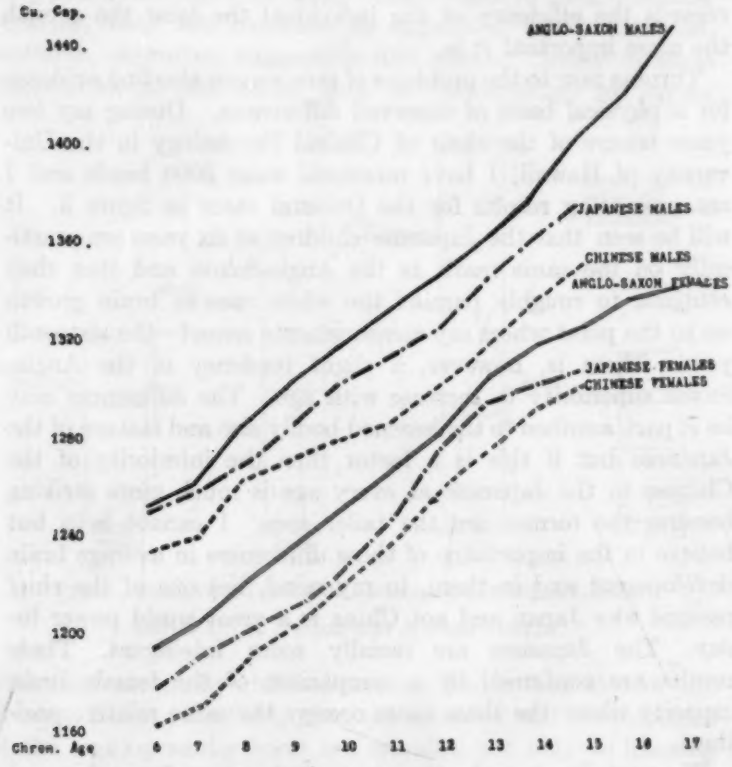


FIG. 3. BRAIN GROWTH IN RACE AND SEX

as being "general adaptability to new situations." I am proposing to substitute for this the simpler but more expressive definition of intelligence as "*progressive adaptability.*" The advantages of this definition are that it can be used to define either individual or racial intelligence, whereas

to speak of "new" problems for the race is beside the mark. The new problems for the individual are the old, old problems of the race. The modified definition puts the emphasis where it belongs, not on the newness of the problem but on the newness of the adaptation. As regards the history of the race, the development of civilization has consisted and will consist in new adaptations to old problems. A further advantage consists in the fact that the proposed definition properly distinguishes instinctive from truly intelligent action. The bee in making its comb or the bird in building its nest may be exhibiting perfection of adaptation to what is, to the individual bird or bee a new situation. But it is not intelligent action because the ability is not carried over to, or does not function in other situations. In other words, it is not *progressive* adaptability. Finally the original definition makes no reference to the value of the adaptation to the individual. It does not emphasize the purposive nature of intelligent action. The modified definition is sufficiently general to make any reference to the value or purpose of the adaptation unnecessary. By embodying in the definition the idea of growth, we can consider any increase of adaptability an increase of intelligence whether it be in a "vertical" or "lateral" direction.

Keeping this definition in mind we can now compare the races in point of present-day achievement and classify them as regards intelligence. The Chinese for instance have had a great history and have made some notable contributions to civilization. They are credited with the invention of gun powder and of printing but their adaptability has not been progressive. In fact they reached a plateau of development many years ago. While they may have been the first to use printing, their alphabet with its thousands of characters was so cumbersome that the invention was of no value to the common people. Racial progress consists very largely in bringing the works of genius within either reach or comprehension of the common people. The Western mind was able to seize on their inventions, to readapt them and to put them

to use. It is not therefore in the field of learning capacity only that we must look for the mental correlates of brain superiority. We must recognize that progressive adaptability is not merely a matter of learning capacity but of the possession of the temperamental qualities of courage, persistence, and determination in the face of difficulties, of ambition and the will to succeed, of foresight and planning capacity and prudence in the execution of plans. Other things being equal as regards mental equipment the individual who possesses these temperamental qualities will succeed far beyond the suggestible, unforeseeing, impulsive, heedless or over-emotional person. The race also which on the average is superior in these characteristics will write its name largely upon the pages of history.

In order to test these important temperamental qualities, I devised a series of tests ten years ago. These consist of a series of printed mazes graded in difficulty through which the individual must trace his way, being penalized in the scoring for every mistake made. Repeated trials are allowed so that it is possible to observe the ability of the person to profit by his errors and to readapt his methods. It is evident that the one who is impulsive, head strong, who leaps before he looks, or who fails to follow a premeditated plan or is nervous, excitable and emotional will tend to become confused and fall into error. Upwards of 1000 children of various races were examined by these and other tests in Hawaii. In learning capacity as measured by the Stanford-Binet test, as was to be expected, there were no very significant differences between the Portuguese, Chinese and Japanese and no very significant sex differences either. None of these groups at any age measured up to the average of 1000 children of Anglo-Saxon origin whom I tested in Australia by the same series of tests and whose performance is indicated in figure 4 by the full black line. The differences, however, may not represent real differences in intelligence but may be due very largely to language disabilities and environmental differences. Japanese children examined in large Californian cities such as San Francisco

and Los Angeles were proved by Darsie[6] to have, on the average, equal intelligence scores to white children.

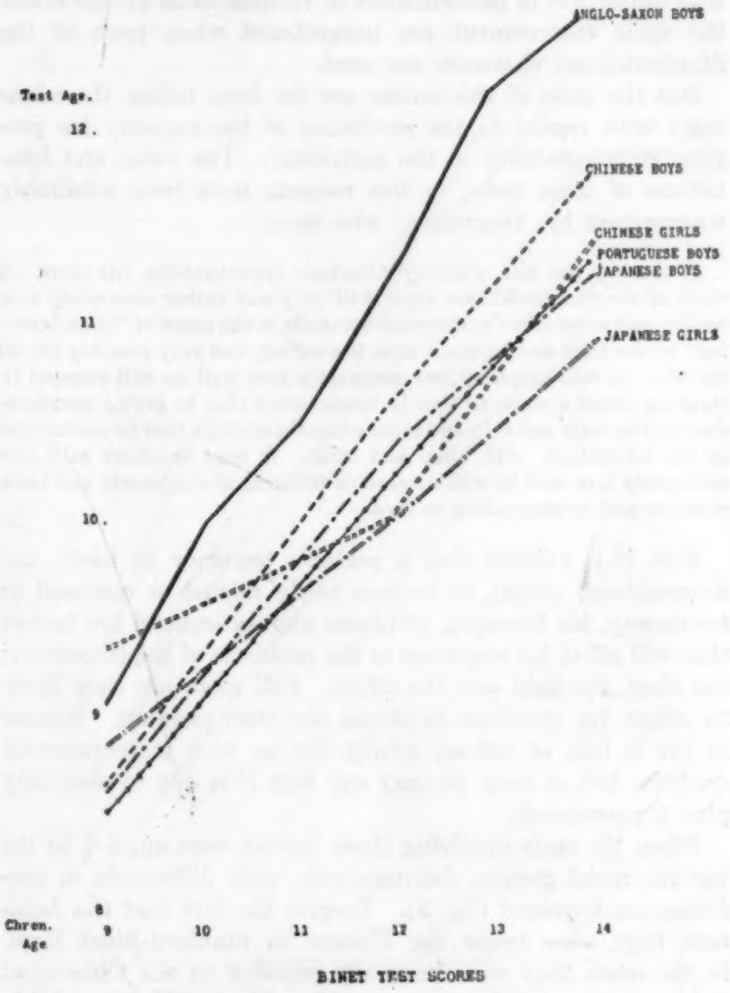


FIG. 4. INTELLIGENCE, SEX AND RACE

[6] M. L. Darsie, Preliminary report on the mental capacity of Japanese children in California.

Leaving aside the comparison of the white children with the children examined in Hawaii, our graph goes to prove that differences in performances of various racial groups under the same environment are insignificant when tests of the Stanford-Binet character are used.

But the tests of this nature are far from telling the whole story with regard to the prediction of the capacity for progressive adaptability in the individual. The value and limitations of these tests, in this respect, have been admirably summarized by Thorndike,[7] who says:

> If the boy has had ordinary American opportunities, his score (in tests of the Stanford-Binet type) will prophesy rather accurately how well he will respond to intellectual demands in the cases of "book-learning" at the time and for some time thereafter, and very possibly for all his life. It will prophesy less accurately how well he will respond in thinking about a machine that he tends, crops that he grows, merchandise that he buys and sells and other concrete realities that he encounters in the laboratory, field, shop and office. It may prophesy still less accurately how well he will succeed in thinking about people and their passions and in responding to these.

Now it is evident that a person's tendency to hasty and ill-considered action, to become easily rattled or confused or conversely, his foresight, prudence and self-control are factors that will affect his responses to the problems of the laboratory, the shop, the field and the office. Still more are they likely to affect his reactions to people and their passions. Success in life is not, of course, wholly due to such temperamental qualities but at least we may say that it is due to mentality plus temperament.

When the tests involving these factors were applied to the various racial groups, comparatively wide differences in performances appeared (fig. 5). Despite the fact that the Japanese boys were below the Chinese in Stanford-Binet level, in the maze they were markedly superior to the Chinese at every age from ten years onwards. Up to the age of ten

[7] Intelligence and its measurement: A symposium. Jour. Educat. Psych., March, 1921.

years they were superior to a group of American children. The Japanese girls, while inferior to the Japanese boys, were

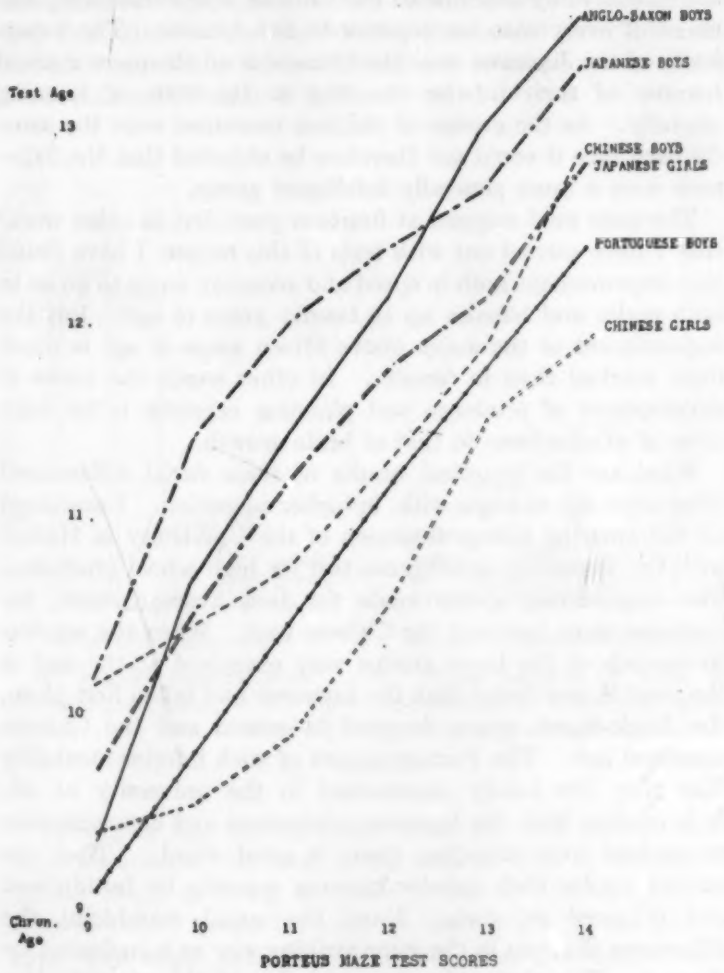


FIG. 5. TEMPERAMENT, SEX AND RACE

ahead of the Chinese girls. Hence we can state that as regards tests of development involving the capacities of per-

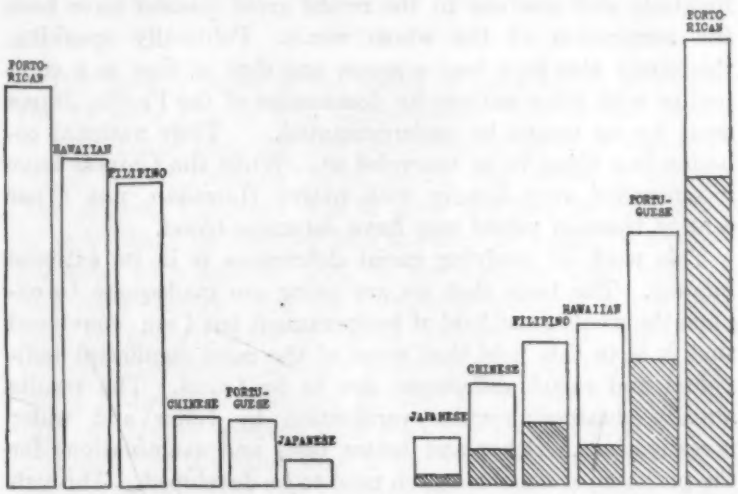
sistent effort, resistance to suggestibility, mental alertness and power to inhibit nervousness and emotion, the Japanese are considerably superior to the Chinese and Portuguese, and males of every race are superior to the females. The superiority of the Japanese over the Chinese is all the more marked because of their inferior standing in the tests of learning capacity. As the groups of children examined were the same for each race it could not therefore be objected that the Japanese were a more generally intelligent group.

The tests used stopped at fourteen years but in other work[8] that I have carried out with tests of this nature, I have found that improvement both in speed and accuracy tends to go on in both males and females up to twenty years of age. But the improvement of the males above fifteen years of age is much more marked than in females. In other words the curve of development of prudence and planning capacity is for both sexes of similar form to that of brain growth.

What are the practical results of these racial differences? They show up, to begin with, in higher education. I examined all the entering college freshmen of the University of Hawaii with the Thorndike intelligence test for high school graduates. The Anglo-Saxon group made the best average score, the Japanese came next and the Chinese next. When the scholastic records of the three groups were examined at the end of the year, it was found that the Japanese had taken first place, the Anglo-Saxon group dropped to second and the Chinese remained last. The Portuguese are of such inferior mentality that they are hardly represented in the university at all. It is evident that the Japanese persistence and determination to succeed were standing them in good stead. They are making up for their inferior learning capacity by faithfulness and diligence in study. From the social standpoint the differences show up in the same striking way as is indicated by figure 6. This shows the representation of the various races

[8] Dorothy M. Bassett and S. D. Porteus, Sex differences in Porteus maze test performance. Publication No. 22, Research Department. Vineland.

in the Territorial Prison proportionate to the percentage of each race in the total population. Criminality in the Japanese, according to these figures, is only one-third that of the Chinese and Portuguese. The unfavorable position of the Hawaiians in this respect may be interpreted not so much as disrespect for law as indifference to jail.



RACE AND CRIMINALITY

Jail inmates proportionate to racial population.

RACE AND MENTAL RETARDATION

Cases referred to clinic for examination. Shaded area—proportion of feebleminded.

FIG. 6

The figure also shows, in the same way, the proportionate representation of the races in the cases referred to the psychological clinic as being mentally retarded. There again the Japanese have proportionately to their quota of the population, the most favorable position. The Portuguese show the biggest percentage of mental retardation, which is to be expected since their scores indicated in many cases inferior learning capacity as well as temperamental inadequacy.

From the industrial standpoint, the statistics of bank deposits show a relatively large increase for the Japanese over other nationalities, 30 per cent of the Japanese having savings accounts as against 10 per cent of the Chinese and 9 per cent of Portuguese. From the national standpoint, the temperamental stability of the Japanese is a wonderful asset. Their fortitude and coolness in the recent great disaster have been the admiration of the whole world. Politically speaking, this study also may bear a lesson and that is, that as a competitor with other nations for domination of the Pacific, Japan must by no means be underestimated. Their national cohesion is a thing to be marveled at. While the Chinese have intermarried very largely with native Hawaiian, not 1 per cent of those of mixed race have Japanese blood.

This work of studying racial differences is in its extreme infancy. The tests that we are using are inadequate to explore the whole great field of temperament but I am convinced that it is in this field that some of the most significant individual and racial differences are to be found. The results already obtained[9] require verification by fuller and wider investigations. Other and better tests and examinations for the purposes of racial research need to be developed. Through the coöperation of the University of Hawaii and the Vineland Laboratory, arrangements have been made for parallel studies on racial differences to be carried on in both places. The research program of the latter institution has been extended so as to include the study of the causes underlying racial as well as individual retardation. To this end a laboratory for racial research has been established there under the present writer.

[9] These results will be fully reported in a forthcoming monograph by S. D. Porteus and M. E. Babcock.

A TEST OF THE DOWNEY WILL-TEMPERAMENT TEST

MELVILLE J. HERSKOVITS

I

The present paper is the result of an attempt to validate the Downey Group Will-Temperament Test before utilizing it in an anthropometric and psychological study of Variability under Racial Crossing upon which the writer is engaged. The original intention was to give this test to such groups of individuals of Negro-White ancestry as might be available together with another test, to see whether there might be any light thrown upon the perplexing question of the existence or non-existence of racial temperamental traits, and, through the results and the genealogical data which are also being gathered, to indicate whether or not there is concomitant variability between such standing and amounts of racial mixture. At the same time it was realized that the practical difficulties of giving the Downey group test in research such as this were not small: it is not simple to gather groups of adults who will consent to be tested, and even more difficult to induce such groups to gather where the necessary physical appurtenances to the Downey test, such as blackboard, adequate places to write, and the like, might be available. It was decided, therefore, to determine through a preliminary study of the test, whether it would show results which would justify its use in the major problem on which the writer is engaged, or not, before so utilizing it.

At the suggestion of Prof. E. L. Thorndike,[1] the following plan of procedure was determined upon: The writer gathered

[1] The writer wishes to express his appreciation to Professor Thorndike for his generous advice in the statistical treatment of the data, and to Miss Margaret Mead for assistance in giving the test to group I, and for arranging for the meeting of group III.

three groups of his personal acquaintances, and the group form of the Downey test was given to each group. The first, numbering 8 individuals, was tested October 31, 1923; only 7 of the tests were utilized, however, for reasons that will be explained below. The second group, of 8 persons, was tested November 12, the third, of 10, November 25. This gave a total population of 25.[2] The groups were so arranged that each person in the group would know every other person well, and, in many instances, intimately. This was the case in every group but the first, and it was because the eighth person in this group was a comparatively recent acquaintance of all except one of the other members of the group, that his score and the ratings of his traits were not utilized. The tests were given where there was adequate blackboard space and writing facilities, and timed with a laboratory stop-watch. After the test had been given, in each case, every person present was given card-index cards numbering as many as there were persons present who had taken the test. On one of these, he was told to write "self," and on each of the others the name of one other person in the group. The self-ratings, however have not been utilized in this study. The cards were next arranged by each individual in the order in which he felt he knew those present (although this was not done in the case of group I) and the writer, who gave all the tests, then announced that each person was to rate every other person on the twelve traits which the Downey test is supposed to test. After the tests had been given and the ratings made, but before the former were scored or the latter tabulated, the writer also rated the individuals in groups I and II.

It is realized that the definitions of the traits, as given by Dr. Downey, are difficult to grasp, but it was felt that it would not be proper to go behind them, and it was attempted to give an equal opportunity for each rater to grasp the meaning of

[2] The smallness of the groups is in accordance with Dr. Downey's recommendation that the number given the group test at any one time be kept low so as to obviate disadvantages of position, hearing, and the like. Downey, The Will-Temperament and its Testing, p. 69.

the names of the traits only by reading those definitions which are given in the *Manual for the Individual Test.*[3] The writer, therefore, would read these definitions as many times as was desired, and until all present seemed to understand them quite clearly, or, at least, ceased asking for re-readings, but no interpretations were attempted. However, since at least two of the groups were composed of persons psychologically sophisticated, it is felt that the handicap of the definitions is perhaps not as great as might be imagined, although it is not denied that they are very elusive. Before the rating was attempted, each person was told that he was to rate everyone else present on a scale of from 0 to 10. This was done so that the scores in the test might be compared directly with the ratings. After the data were all in, they were treated statistically as will be shown below. Before entering on a statistical exposition, however, it may be well to give a sketch of the groups and their composition, for they represent three distinct types as to occupation, and, at least in one case, perhaps, as to temperamental qualities. It will be remembered that Dr. Downey, in discussing an earlier attempt to evaluate this test, states that "One cannot help wishing that Ruch had gone somewhat into case-studies, which would undoubtedly have illuminated his findings."[4] Space will be taken, therefore, to give the age, sex, years of schooling, relationship, if any, to other members of the group, occupation and other information about each person who took the test as may be pertinent to the discussion in hand. The three groups will be spoken of as groups I, II, and III, respectively, and the individuals by number under their respective groups: thus, individual I 3 would be the third individual in the first group, III 3, the third in the third group. The numbers will be used consistently throughout this paper.

[3] June E. Downey, Downey Individual Will-Temperament Tests. Manual of Directions, 1922, p. 19 ff.

[4] Op. cit., p. 177. A similar statement is made by Dr. Downey in her article, Testing the Will-Temperament Tests, School and Society, vol. xvi (1922), pp. 161–168.

Group I, composed of 8 persons, contained all but 2 who were musicians or artists. Four of the 8 constitute members of one family, and might therefore be expected to know each other exceptionally well. Of the remaining 4, 1 has been closely known to this family for over five years, a second for over three, a third, for almost a year, while the last, whose score and the estimates of whose traits were discarded, has only known and been known to the rest of the group for a few weeks. I 1 is a young woman, twenty-two years of age. She is a pianist by profession, and has had a secondary school education, supplemented by work at Columbia University as a special student. She is the daughter of I 4 and I 6, the sister of I 3, and studies piano with I 5. I 2 is also a pianist by profession, and has had a secondary education and some college work. She is nineteen years of age, and is particularly well known to I 1, I 3, and I 4, who were the only ones rating her. I 3 is the son of I 4 and I 6, is eighteen years of age, and a second-year student at Columbia College. His mother, I 4 is a violinist of repute in musical circles, forty-two years of age, with a secondary school education followed by extensive musical training. She was perhaps better known to all the members of the group than any other person in it, and, in turn, knew all others perhaps best. I 5 is a pianist, a man twenty-nine years of age, a well-known concert artist, accompanist, and composer. He completed a college course, and is continuing his studies in the field of science, being also an able mathematician. He is a person of very positive traits, and it is interesting to notice (see table 1) that the averages of the estimates of his traits ran unusually high, the lowest being 7. He has been well known to the members of the family in this group for over three years, and, as has been said, is the person with whom I 1 studies at present. I 6 is a lawyer, forty-seven years of age, the husband of I 4 and the father of I 1 and I 3. I 7 is a singer, thirty-six years of age, with a public school education. He, too, has very definite temperamental traits, and was judged by 5 of the other persons present. I 8 is an illustrator, but, since he was not well known

TABLE 1

Scores and averages of estimates of persons tested

INDIVIDUAL		TRAIT	A	B	C	D	E	F	G	H	I	J	K	L
I	1	Test score	7	5	7	6	5	5	1	8	5	3	2	3
		Average rating	7⅜	5½	5½	3½	6⅜	4⅜	4⅜	3⅜	4⅜	7⅜	5½	5½
I	2	Test score	3	10	3	2	4	7	1	2	1	10	8	9
		Average rating	6½	5¾	4½	8½	6	6¾	6½	6¾	4⅜	4½	4½	2
I	3	Test score	4	9	5	9	3	5	5	2	8	9	1	4
		Average rating	6½	6¾	4½	5½	5⅜	5½	4½	4¼	5½	8½	6⅜	7½
I	4	Test score	8	10	5	4	3	3	10	6	6	10	1	1
		Average rating	5½	5½	6½	6½	8	5½	6⅜	4	6	5½	4½	7½
I	5	Test score	9	7	8	3	6	9	7	2	9	10	10	7
		Average rating	9	8½	7	8⅜	7½	8	8⅜	7¼	8⅜	8⅜	7½	8¼
I	6	Test score	8	9	6	6	2	2	1	8	4	10	9	10
		Average rating	6½	6¾	6¼	8	6¾	9¼	8¾	9	6½	7½	8½	5¾
I	7	Test score	4	9	0	8	8	1	2	2	1	7	1	7
		Average rating	6½	8	5¾	7⅜	6¼	6⅜	6¾	6½	7	7¼	6½	6⅜
II	1	Test score	10	6	4	10	5	6	3	9	5	8	5	10
		Average rating	6	5⅞	5¼	6½	6½	8⅛	7⅞	7½	6⅞	6⅞	5⅛	5⅞
II	2	Test score	4	5	6	5	5	7	2	3	4	8	9	2
		Average rating	7⅞	6⅞	5	6⅝	6⅞	8	9⅞	8⅝	7⅝	7⅛	7⅜	7⅞
II	3	Test score	1	1	4	5	6	2	6	10	9	4	1	5
		Average rating	5⅛	7½	6⅛	5⅛	6½	7½	7⅞	8	8¼	6⅛	6⅛	8¼
II	4	Test score	5	10	6	10	4	2	5	2	3	10	3	3
		Average rating	6½	6⅞	4⅜	5½	6⅞	5	5⅝	7	6⅝	8½	7	8½
II	5	Test score	6	8	6	6	5	1	9	5	3	8	6	3
		Average rating	6½	6	6¼	5⅞	6	6⅛	5⅝	5½	6	6⅛	7	5⅛
II	6	Test score	4	6	7	10	5	7	4	2	1	8	6	9
		Average rating	6½	6¼	6⅛	6½	7⅛	7⅛	6⅛	6¼	7⅛	6¾	5¾	6½

TABLE 1—*Continued*

INDIVIDUAL		TRAIT											
		A	B	C	D	E	F	G	H	I	J	K	L
II 7	Test score	3	10	2	10	4	8	10	4	6	7	2	5
	Average rating	7¾	7½	6⅞	6½	8½	6½	7	5⅝	5⅝	7⅝	6⅜	7¼
II 8	Test score	10	9	6	7	6	1	5	9	4	9	9	2
	Average rating	8¼	8¼	5½	7⅛	8⅜	7½	7⅜	7½	7⅛	5⅜	6⅛	7¾
III 1	Test score	10	10	2	8	9	5	8	10	10	8	10	2
	Average rating	8⅝	9⅜	6⅝	8⅝	6⅞	9½	9	9½	7⅛	8⅛	8⅞	8⅝
III 2	Test score	8	9	9	6	5	3	4	4	3	10	7	7
	Average rating	6⅝	4½	7	5¾	7½	5⅝	6⅜	5½	4	4¾	6⅞	5⅞
III 3	Test score	6	5	6	—	4	2	6	—	2	7	3	7
	Average rating	3⅞	6	4¾	—	3⅝	4⅝	4⅜	4⅜	5⅞	5⅛	4¾	7
III 4	Test score	7	6	8	5	5	4	4	10	2	10	7	6
	Average rating	7⅛	6½	5½	7⅒	7½	7½	7½	7⅜	5⅞	5⅛	5½	6
III 5	Test score	10	9	3	4	5	3	1	4	6	7	10	1
	Average rating	5⅝	3	6½	5⅞	5¾	4⅞	3⅛	4⅞	5½	3⅝	4⅛	3⅛
III 6	Test score	10	8	8	5	7	3	6	9	9	10	8	1
	Average rating	6½	6⅞	5¾	5¾	5⅝	7½	6⅝	7	7⅛	6⅝	6¾	7⅛
III 7	Test score	7	6	7	5	8	6	1	6	6	10	10	8
	Average rating	8¾	3¾	6⅞	5⅛	8½	6⅛	5	5	5⅛	5⅛	6⅜	6⅛
III 8	Test score	10	9	6	3	3	2	2	10	3	5	1	8
	Average rating	6⅛	6⅛	7⅝	6⅛	6⅜	7⅝	7⅛	7⅛	5⅝	4⅜	6⅛	7
III 9	Test score	10	8	4	4	3	1	3	10	8	10	8	1
	Average rating	5¾	4⅞	4½	5	4⅛	7¾	6⅞	7⅛	5⅛	6⅞	5⅛	4
III 10	Test score	10	9	8	4	4	2	6	10	9	10	6	1
	Average rating	5⅛	5⅞	4⅝	6⅛	5⅛	6½	5⅝	6⅛	4⅛	6⅜	5⅝	4⅛

to the others, his score and the estimates of him were not utilized. However, he is an intimate friend of I 7, and therefore his rating of the traits of I 7 were used. His estimates of

other persons present were not used. The estimates which I 2 and I 7 made of the others present, were, for the most part, not utilized, because both of these were evidently either unused to rating persons on a scale or impatient in doing so, most of the scores being either 5, 8, or 10, with an occasional 0. The writer himself later rated all the persons in this group, the independent judgments thus numbering from 4 to 6 for each trait of each person.

Group II consists of persons who are either professionally engaged or in business, and is much more homogeneous from the point of view of the age of its members than is group I. The persons in it have been associating together socially for at least five years, and many of them longer; in addition, 2 of the members are husband and wife, while another is the brother of the husband. The group is closely knit, and the members have spent much time together, and are eminently fit to judge each other as this test of the Downey test requires. II 1 is a business man, twenty-five years of age, who attended college three and one-half years. II 2 is an engineer, who holds the degrees of B.A. and M.E., and is twenty-four years of age. II 3 is a broker, twenty-two years of age, who has had two years of advanced educational training, though he has never worked for a degree. He is the brother of II 6, and the brother-in-law of II 7. II 4, a woman twenty-seven years old, holds the degree of B.A., and is a private secretary at present in charge of a large relief organization. II 5, a woman of twenty-five, is a social worker and was rated "best known" by the three other persons in the group. She is a college graduate. II 6, the husband of II 7 and the brother of II 3, is a salesman, who has had three years of college training. He is twenty-four years old. II 7, twenty-two years of age, describes herself as "housekeeper-student," and was for some years a bacteriologist. II 8 is also twenty-two years of age, holds the degree of B.A., and is a psychiatric social worker. As might be expected in a group where all the members know each other so well, only in 1 case did each fail to rate all the others. All but one was also rated by the writer, thus giving

8 independent judgments in practically every trait of every test taken.

Group III is homogeneous from every point of view. The age range is from nineteen to twenty-three; all the members are students or graduates within the past year of the same college, 2 holding the degree of B.A., 1 being a second-year student, the others third- or fourth-year students. Finally, all the 10 members of the group lived together for a year in an apartment which is being used as a dormitory by the college which they all attend or attended, and hence know each other exceptionally well. Further, they are all given to considering each other's traits, and are highly competent to participate in such a test as this. Several members, not now undergraduates, may be mentioned: III 1 is at present taking graduate work in psychology and anthropology. She is a person of very definite temperamental traits, and is unusually well known to all the members, as is witnessed by the fact that she is rated lower than "second best known" by only 2 out of the 9 judging her. III 2 is a journalist, and was the room-mate of III 7, a poet, each of whom rated the other "best known." The writer did not rate the members of this group, so there are 9 judgments for each trait of each person, except in a few cases in which 1 individual did not rate 1 person on 2 traits, and another on 7. III 3 arrived as test III was being given, which means that no scores might be given on traits D and H. Therefore, in the correlation of the standing in the traits and the averages of the ratings N equals 298 instead of 300. In the other groups, occasionally an individual would rate another on less than the total number of traits, and this is the reason that the total number of ratings, 2152, is not as great as it would be had everyone rated everyone else on every trait. It was felt, however, that it was not desirable to insist on complete ratings, but that a sacrifice of numbers in the interest of the greatest possible accuracy in rating was most to be desired.

II

The Downey Will-Temperament Group Test, it will be remembered, is a battery of 12 tests based mainly on handwriting valuation. It may be well to give a list here of the traits which are tested; it would be highly desirable to also give the definitions of those traits given by Dr. Downey, but space forbids, and they may be consulted in the place already referred to. The traits are:

A. Speed of movement, VI–1
B. Freedom from load, VI–1–2
C. Flexibility, VIII
D. Speed of decision, I
E. Motor impulsion, X
F. Self-confidence, XI
G. Non-compliance, XII
H. Finality of judgment, XIII
I. Motor inhibition, VII
J. Interest in detail, IX
K. Coördination of impulses, V
L. Volitional perseveration, VIII–2

The first correlation which was computed was that between the score of a given person in a trait and the estimates made by each of his acquaintances of his standing in that trait. That is, every score was tabulated once for every estimate of it, and the result, computed from a total of 2152 independent judgments, by the Pearson product-moment formula, gave

$$r = 0.06$$

The probable error of the coefficient, computed by the formula $\text{P.E.}_r = \frac{0.6745(1 - r^2)}{\sqrt{N}}$, is

$$\text{P.E.}_r = \pm 0.012$$

At the same time, it was felt that the low result which obtained from this correlation might be due to several statistical faults, among which might be the correlation of heterogeneous data, or the undue weighting given the scores as against the in-

dividual ratings. It was therefore determined to average the ratings of each individual on each trait. This seemed advisable for several reasons, not the least of which is the fact that, as has been amply demonstrated, the reliability of the averaged ratings of a trait in a person comes much nearer being a criterion of the extent to which that person has that trait than single judgments.[5] This was accordingly done and the result, by the Pearson product-moment formula, gave

$$r = 0.13$$

while the probable error, by the formula given above, gave

$$\text{P.E.}_r = \pm 0.038$$

It was felt, however, that a further closer statistical analysis of the data was to be desired before any conclusions might be drawn as to the usability of the test, and therefore correlations were computed for each of the 12 tests comprising the battery, the correlation being score in test times average of the estimates, as it was felt that for the reasons above given the averages would be the most reliable to be used, while the individual ratings would not give a sufficient number of cases if correlations were computed from them for each test, to be of any significance. For this series of correlations, the Spearman Method of Rank-Differences was used, the formula being $\rho = \frac{6\Sigma D^2}{N(N^2-1)}$. The results are shown in table 2. The correspondence of the mean, 0.12 ± 0.03, is strikingly close to Meier's[6] average of the pooled correlations of test scores with estimates of three sets of judges, his being 0.1183 $\pm$ 0.08.

It is to be noted that Dr. Downey stresses the value of her test as diagnostic of the "mental set" of a person,[7] and lays

[5] H. L. Hollingworth, Judging Human Character, p. 69. Harold O. Rugg, Is the rating of human character possible? Jour. Educat. Psychol. vol. 12 (1921), p. 425 and ff.

[6] Norman C. Meier, A study of the Downey Test by the method of estimates, Jour. Educat. Psychol., vol. xiv (1923), p. 389.

[7] Op. cit., p. 73.

great stress on the profile rather than on the quantitative standing in her tests. At the same time, it cannot be denied that, valuable as a profile-method of determining character may ultimately be, it cannot be utilized so long as there are no established norms with which to compare a given profile, in a definite case. And these norms cannot be developed other than statistically, and since statistical procedure is essentially a matter of dealing with quantitative data, it is well-nigh impossible that the psychographic means of presentation

TABLE 2

Correlation between scores in tests and averages of estimates of traits

TRAIT	ρ	N
A. Speed of movement	−0.03	25
B. Freedom from load	0.18	25
C. Flexibility	0.12	25
D. Speed of decision	−0.05	24
E. Motor impulsion	0.21	25
F. Self-confidence	0.10	25
G. Non-compliance	0.18	25
H. Finality of judgment	0.35	24
I. Motor Inhibition	0.29	25
J. Interest in detail	−0.001	25
K. Coördination of impulses	0.28	25
L. Volitional perseveration	−0.14	25

Mean = 0.12 ± 0.03
Median = 0.15 ± 0.04
$\sigma = 0.15 \pm 0.03$

can be considered here, or other than scores be utilized. It will be remembered, however, that Dr. Downey in her discussion of the profile divides temperaments as shown by the tests into three types, those in which the traits A to D predominate, giving the type showing "speed and fluidity of reactions," those in which traits E to H come out strongly, the type of "forcefulness and decisiveness of reaction," and those in which traits I to K are pronounced, the type exhibiting "carefulness and persistence of reaction."[8] If the table

[8] Op. cit., p. 62.

of correlation of the individual traits be noticed, it will be seen that there is no pronounced homogeneity in any one of these sets of traits. In the first four, the correlations vary from -0.05, to 0.18; in the second, from 0.10 to 0.35; in the third, from -0.14 to 0.29. It would seem that the second grouping is the most significant, but the reliability of coefficients as low as these is to be highly doubted. Ruch and Del Manzo[9] found a similar range of variation in the correlations of trait-scores and estimates, the lowest being -0.04 (trait G) and the highest 0.53 (trait K). There is little correspondence between their findings, and those of the present study, however, a rank-correlation of the two giving $\rho = -0.14$.

It was felt, however, that there were still many discrepancies in the statistical procedure and method of approach to the problem which might be criticized,—the lack of understanding of the definitions of the traits when read, the smallness of the number of persons tested, and the like. Therefore, it was determined to correct the correlations for such attenuation as might be involved in chance errors arising from the giving of the tests or the rating process. A method has been provided by Spearman[10] whereby correction of this factor of chance error may be made. It is, to quote Kelley,[11] who presents several variations of it, "a promise of the correlation that one might expect to find if one had perfectly reliable measures." In other words, it is the correlation beyond which it is not possible to go, but between which and the coefficient calculated any future coefficient computed from comparable data might be expected to lie. The form used here is the modification suggested by Thorndike,[12]

$$\sqrt{r_{xy}} = \frac{\sqrt{(r_{x_1y_2})\ (r_{x_2y_1})}}{\sqrt{(r_{x_1x_2})\ (r_{y_1y_2})}}$$

[9] The Downey Will-Temperament Test, a further analysis of its reliability and validity, Jour. Appl. Psychol., vol. vii (1923), p. 74.

[10] Amer. Jour. Psychol., vol. xv (1904), pp. 72-101; ibid., vol. xviii (1907), pp. 161-169; British Jour. Psychol., vol. iii (1910), pp. 271-295.

[11] Statistical Method, p. 208.

[12] Mental and Social Measurements, p. 179.

To use this formula, there needs to be intercorrelation between two independent series of the same data, represented by $r_{x_1x_2}$ and $r_{y_1y_2}$, and the correlations between the first and second series, and the second and first, respectively, represented by $r_{x_1y_2}$ and $r_{x_2y_1}$. In the present use of the formula, the following procedure has been used:

Let $r_{x_1y_2} = 0.124$, the mean of the correlations of the Downey scores of individual traits times the averages of the estimates of those scores,

$r_{x_2y_1} = 0.127$, the product-moment correlation of the Downey scores times the averages of the estimates of those scores,

$r_{x_1x_2} = 1.00$, an assumed perfect correlation between scores from trials of the Downey group test, a coefficient more favorable than might be expected, or than has been shown, and let

$r_{y_1y_2}$ = an intercorrelation between sets of ratings. Let this correlation vary, and let r_{xy} be computed when it is assumed to be 0.10, 0.30, 0.60, and 0.90, respectively.

Then, when $r_{y_1y_2} = 0.10$, $r_{xy} = 0.39$
$= 0.30$, $r_{xy} = 0.23$
$= 0.60$, $r_{xy} = 0.16$
$= 0.90$, $r_{xy} = 0.13$

It must be remarked again that these coefficients are corrected for attenuation, and are what might be expected if all the chance errors due to defects in the measures were eliminated, and that they must therefore be higher than they are to let us postulate reliability in the test when judged, at least, by the criteria of the opinions of raters who are familiar with the subjects tested and competent to rate them.

III

In view of the tests of the Downey group test which have been carried on in the manner described above, and the results which statistical analysis of the findings gives us, it is felt that great caution should be exercised in the use of this test. While it is freely admitted that ratings by individuals of their acquaintances may vary tremendously, and that

single opinions may be dismissed as worthless, it must be remembered that the low correlations shown above result from the average of no less than 4, and in many cases as high as 9, opinions given by raters who were selected for the reason that they knew the persons that they rated exceptionally well. The higher the number of opinions averaged, the more reliable the average becomes for purposes such as this. Certain defects in the present treatment must be taken into consideration, of course: thus, in the tabulation of tables of the ratings, it was found that there was a distinct tendency in at least one group to lean toward the upper range, possibly from the invidious nature of the associations with the lower numbers of the scale "0 to 10." Again, as has been mentioned, the small number of persons tested might well influence the result, or the qualitative element involved in scoring certain of the tests may contribute toward error. On the other hand, the lowness of the correlation when corrected for attenuation is impressive, and certainly points toward the need for further very careful research into this test before it can be used. Certain of the individual traits show trends that may indicate that stress should be laid on them in future attempts to devise tests of character and temperament, while the possibility always present that the tests are really testing something other than defined by Dr. Downey must not be forgotten. Certainly such tests, if tenable norms can be established, may show results which will be of value in the study of problems such as the one on which the writer is at present engaged, but the Downey group test still needs a great deal further revision if it is to be of use along these or other lines. What changes need to be effected it is not in the province of the writer to state. It is certain, however, that until such researches have been made and established, the greatest caution must be utilized in drawing conclusions from this test

THE IMMEDIATE HEREDITY OF PRIMARY AMENTS COMMITTED TO A PUBLIC INSTITUTION

A Study of the Parents of Forty-Five Institutional Cases

V. MOORREES[1]

I. OBJECT OF STUDY AND METHOD OF COLLECTING DATA

The prime object of this study is to try to discover what type of mentality is represented by the parents of children who are inmates of an institution for the feebleminded, and what relation, if any, exists between the mental ages of these primary aments and those of their parents. In the treatment and consideration of the data collected, other issues will quite naturally arise. The relation of their intelligence quotients to the occupations and wage earning capacities of one or both parents, the relation between the mental ages of wives and husbands, facts gathered from the clinical histories are all of importance and will be dealt with according to their intrinsic values.

The material for the study was collected on Randall's Island, where is situated the New York City Children's Hospital, an institution which accommodates approximately 1250 patients. Since the results of the investigation were to be treated statistically, it was of the utmost importance that the selection of cases should be, as far as possible, a random one, the more so in view of the fact that the institution is in its nature selective, certain classes of people sending their children there, while others more fortunately situated make provision for them in private institutions or in their own homes.

[1] In collaboration with L. E. Poull, Ph.D., Psychologist, New York City Children's Hospital, Randall's Island.

From the day on which the study was taken up, the selection of cases was made both from the new admissions and from those already admitted, the names of the former being taken from the register, working backward in strict order.

In selecting the children for this study the following were regarded as being unsuitable to figure in it:

1. Clear cases of secondary amentia.
2. Epileptics or such cases as showed a history of convulsions.

This selection was not based on the belief that the epilepsy and feeblemindedness are necessary concomitants or that they stand to one another in the relation of cause and effect, but the performances of epileptics are so erratic as to invalidate any statistical application. As regards convulsions, it is very difficult from the meager details and inaccurate descriptions furnished by parents, to decide whether the convulsions are epileptic seizures or ordinary infantile convulsions due to teething, etc.

3. Abandoned children, whose parents could not be reached and children who had lost either or both of their parents.

Parents were interviewed and arrangements made for them to come to be tested. This opportunity was further utilized for getting additional information as to the family history and generally for checking the records already filed in the office of the institution. Most of the parents were willing to coöperate, especially when told that they were assisting in the study of the cases of their children. A few had to be urged more strongly, and in 2 cases only, where a discharge had already been secured, was the request met by a refusal.

The tests used were as occasion demanded, the Kuhlmann-Binet, the Pintner-Patterson Performance, but a glance at table 1 will show that these cases were comparatively rare, and that the scale most extensively used was the Performance. Whether this scale adequately represents the persons tested and what its relation to the Binet is, will be discussed later on.

In accordance with Terman's findings and the accepted clinical practice, the I.Q's, of the parents were worked out on the basis of *fifteen* years.

Certain tests of the Performance Scale were omitted to avoid the preponderance of a type of test which it was felt really measured the same function. These tests were the Triangle, the Two-Figure, the Four-Figure and the Five-Figure.

(Throughout the study, the term Binet refers to the Stanford Revision of the Binet-Simon tests.)

II. REVIEW OF PREVIOUS STUDIES

The close resemblance between parents, grandparents, and children, with reference to both physical and mental traits, has been a matter of common observation for a considerable period and several studies have been undertaken to establish these resemblances and give them a quantitative value.

These studies are so widely known and have been so often quoted that they do not demand more than a bare reference to their results. They fall roughly under two heads:

1. Biometrical studies, which attempt to estimate statistically the correspondence between parents and offspring with reference to certain physical traits.

2. Psychological studies which attempt to do the same with reference to mental traits.

To the first class belong the studies of Pearson and Galton who worked on the quantitative correspondence between parents and offspring with reference to certain physical features. Pearson in *Nature and Nurture* found the average correlation to be somewhere near 0.5. This type of study can only be valid if the things measured are properly classified and enumerated.

More interesting perhaps are the studies that fall under the second head. Among the first of these is Galton's study of 977 eminent men, this number representing a selection from among 4000 persons. These 977 men had 535 relatives of the same degree of eminence. His general conclusions are that men of ability rise above their environment, especially if many opportunities are given them; further that men cannot achieve great eminence unless they have extraordinary natural

abilities. Cattell's study of scientfic men in the United States generally confirms these conclusions.

Woods made a study of hereditary mental and moral traits in royalty. The persons figuring in this study were rated on a scale ranging from 1, which denoted lack of mental and moral stability or capacity, to 10, which was the mark given to persons who were exceptionally gifted in morality or intellect. That the hereditary factor figures strongly in the possession of these traits, is shown by the fact that the greatest distribution of exceptional persons fell into 4 of 15 royal families.

He also arrived at the conclusion that the right of succession had no effect on ability. On the whole he attributed 90 per cent of the possession of the traits to heredity. This was hardly justified since his correlation between father and offspring was 0.30 and the persons were rated according to subjective estimate.

Starch found that the average correlation between brothers and sisters, when measured for such capacities as reading, spelling, writing, etc., was 0.42. The correlations in the group ranged from 0.05 to 0.72. In the tests for memory, cancelling A's, etc., he found an average of 0.38, ranging from 0.07 to 0.65. On ranks in all tests combined the coefficient was 0.73. There are similar studies by Dexter and Earle and an interesting research by Schuster and Elderton. Thorndike's correlations between the performances of twins rank very high, the lowest being 0.69 and the highest 0.90.

Two studies, which have a closer relation to this research, in that they are concerned with the inheritance of mental deficiency, are those of Goddard and Tredgold. Of the 327 cases that form the basis of Goddard's study, 54 per cent showed "other feebleminded persons in such numbers or in such relation to the individual cases as to leave no doubt of the hereditary character of the mental defect." Under the heading of "probably hereditary" the percentage is 11.3. The remaining cases are divided among "neuropathic ancestry, accident," and cases for which no sufficient cause could be shown. The number of unclassified cases is 27. Tred-

gold found that 64.5 per cent of his cases showed hereditary conditions of amentia, insanity or epilepsy, though how large a percentage is to be attributed to amentia alone is not evident from his study. Beyond the fact that he employed the usual clinical procedure in obtaining a case history, there is no other evidence from Tredgold's Manual as to how he arrived at the facts concerning mental deficiency in the ancestry of his patients. The methods used by Goddard's field workers are clearly described in his text.

We see at once that neither of them used instruments of precision for gauging the mental capacity of parents or other ancestors, though naturally many factors would have operated to make such a procedure impossible to the latter case. Two facts are evident:

1. That however well trained a field worker may be, or however shrewd the source of indirect evidence, there is always the possibility of error.

2. If it had been possible for them to use standardized tests it is more than likely that a higher percentage of mental deficiency in the ancestry of the cases investigated would have been found. As they stand at present the cases presenting well defined features would have been noted, but the more subtle distinctions could not be accurately gauged by subjective estimate. The clinical history in England, where a comparatively negligible language difficulty exists, is likely to be more precise than it is here in America.

In many of the cases reviewed for this study, the deponents did not know whether their parents were alive or dead, or in the latter case what the causes of death were. Similar information as to collaterals furnished the same difficulty. The descriptions of diseases in infancy were often inaccurate, especially, as has been pointed out before, with reference to convulsions. The tendency to exaggerate the health and normality of the family on the whole was evident. It is reasonable to suppose then that even with the maximum of care, errors may creep into the data. Even after the most rigorous sifting, 5 of the 50 cases on which it was first intended this study should be based, had to be abandoned.

However, the researches of Goddard and Tredgold place mental deficiency in the ancestors in a very close and obvious relation with the same condition in the offspring, or descendants. This relation is further proved by the investigation of such families as the Jukes, Nams and Kallikaks. The figures quoted by other authorities come strikingly near the estimate of Goddard; Wilmarth gives 66 per cent and Rogers 65 per cent. The whole mass of evidence seems to point to the fact that heredity plays a strong part as far as the inheritance of mental, moral, and intellectual traits is concerned. It would be unreasonable to assume that the hereditary factor is operative in the case of physical resemblances and not in the case of the other factors listed above.

On the other hand to minimize the influence of environment in so far as it offers facilities for development would be crude and unscientific and one could not do better than quote Giddings in his introduction to Dugdale's study of the Juke family:

> No scientific man would say that we know enough about human heredity to justify the social reformer in basing any very radical, practical program of social reform upon biological conclusions. We can only say that probably heredity is a fateful factor in the moral, and therefore the social realm, but that we need an immense amount of patient research to determine exactly what it is and what it does.

III. PRESENTATION OF THE DATA

The results of the studies summarized in the preceding section point to the conclusion that mental traits are hereditary, though to what degree and along what lines is, at present, not clearly established.

However varied the interpretation of feeblemindedness may be, from the clinical standpoint a person who is mentally deficient is one, who, when no other adequate reason can be found, cannot in certain tests reach the standards that have by careful experimentation been determined for normal persons. It is from this point of view that the following data are presented and from this point of view that they should be interpreted. Table 1 shows the data collected in as compact a form as possible.

It will be noticed at once that only 9 of the children show I.O's based on the Performance Test, whereas all of them have had a Binet or a Kulhmann-Binet. The reason for this is that the children were either too young or too low in mentality to handle the material for the Performance Test. On the other hand, owing to language disability, only 20 of the parents have had a Binet, whereas all of them have had a Performance Test. These facts, will, however, not invalidate a correlation between the two groups, if we use only Binets or Kuhlmann-Binets in the one case and only Performance in the other.

Three successive columns give the average score of the parents, and the scores of those who made a higher or a lower score. The last two columns are meant to give an abbreviated clinical sketch of each case, the most important facts having been selected and presented. In the columns where the children's Wassermanns are tabulated "N" means a negative reaction to the test; "D." doubtful: "B.N.O." that the blood was not obtained, and a blank, that there was no return in that case. Table 2 shows the central tendencies and variabilities of such facts as are of interest.

Interpretation of table 2

Q1 is the point on the scale below which lie 25 per cent of the cases and above which lie 75 per cent. Similarly Q3 is the point below which lie 75 per cent and above which lie 25 per cent of the cases. The median is the point on each side of which lie 50 per cent of the cases.

Thus in the column of children's scores, 25 per cent of the children fall below 19.3; 25 per cent between 19.3 and 29.4; 25 per cent between 29.4 and 49.4; and 25 per cent above 49.4. Thus also 50 per cent lie below and 50 per cent above 29.4, and 50 per cent lie between 19.3 and 49.4.

Q is derived from the formula

$$\frac{Q3 - Q1}{2}$$

TABLE 1*

PATIENT	I.Q. BINET (STANFORD)	I.Q. BINET (KUHLMAN)	I.Q. PERFORMANCE	WASSERMANN	AGE IN YEARS	FATHER (A)					MOTHER (B)					AVERAGE I.Q. OF PARENTS	I.Q. OF PARENT MAKING LOWER SCORE	I.Q. OF PARENT MAKING HIGHER SCORE	INFANTILE DISEASES OR DISEASES IN INFANCY	REMARKS
						I.Q. Binet	I.Q. performance	Age	Weekly wage	Occupation	I.Q. Binet	I.Q. performance	Age	Weekly wage	Occupation					
1		24		N.	5		73	46	$35	Varnisher		53	39	$		63	53	73		Pituitary microcephalic.
2		51			5	88	92	27	14-20	Laborer	87	66	27			79	65	92	Measles, rectal operation	Maternal grandmother died at 36 of cancer
3		10		N.	9		90		45	Cutter	82	53	43			62	53	70	Measles	Second cousin feeble minded
4	43		43		17	85	66	54	35	Paper-cutter	91	73	50		Factory hand	69	66	73	Chicken-pox, whooping cough, measles, scarlet fever, chorea	Father's Wassermann positive
5	70		72	N.	10		67	33	30	Window-washer		51	30			59	51	67	Chicken-pox, measles, whooping cough, tonsilectomy	
6		23		N.	10	86	60	48	40	Baker	85	53	45		Factory hand	57	53	60	No illnesses	Father was alcoholic
7	39			N.	12		60	48	20	Farm-hand		60	42			60	60	60	Measles, whooping cough, mumps, pneumonia, chorea	

8		23		D.	6		74	43	35	Agent wholesale grocer		47	35			61	47	74	No illnesses	Instrumental delivery, microcephalic
9		25		B.N.O.	2		97	30	32	Tailor	120	80	27			89	80	97	No illnesses	
10	56		58	N.	15	94	87	49	25	Hoisting Eng.	67	30	41			69	50	87	Measles, whooping cough	
11	45		48	N.	16		60	55	25–30	Iceman and peddler		40	40			50	40	60	Measles	
12		64		N.	4	81	53	55	25	Tailor	87	63	41			58	53	63	Measles, chicken pox, tonsilectomy	Instrumental delivery
13		12		N.	11		40	47	75	Fruit-peddler		47	40			44	40	47	Diphtheria, pneumonia, measles	Mongoloid type
14	78			N.	6		60	40	28	Tinsmith		40	40			50	40	60	Measles, anterior poliomyelitis	
15		17		N.	7		47	50	35	Presser	98	77	38			62	47	77	Pneumonia, diphtheria, otitis media	
16		51		N.	7		77	37	25–30	Shoe-maker		53	33		Servant	65	53	77	Tuberculosis of bowels, influenza	
17		22		D.	7		86		24	Mechanic		53	37		Sales clerk	70	53	86	Whooping cough	
18		22		B.N.O.	5	89	93	34	25	Parquet floor worker	69	66	28			79	66	93	No illnesses	Maternal grand aunt insane, maternal uncle insane
19		5		D.	7		50		35	Time-keeper		45				48	45	50	Diphtheria, asthma	Microcephalic
20		20		N.			80	30	28	Tailor		67	26			74	67	80	No illnesses	Microcephalic
21		37		B.N.O.	3	92	93	42	30	Gramophone repairer	86	63	42			78	63	93	No illnesses	Typical mongolian

* I. Q.'s on the Performance Scale were raised in accordance with the statistical findings reported in Section 3.

TABLE 1—*Continued*

PATIENT	I.Q. BINET (STANFORD)	I.Q. BINET (GOODENAF)	I.Q. PERFORMANCE	WASSERMANN	AGE IN YEARS	FATHER (A)					MOTHER (B)					AVERAGE I.Q. OF PARENTS	I.Q. OF PARENT MAKING LOWER SCORE	I.Q. OF PARENT MAKING HIGHER SCORE	INFANTILE DISEASES OR DISEASES IN INFANCY	REMARKS
						I.Q. Binet	I.Q. performance	Age	Weekly wage	Occupation	I.Q. Binet	I.Q. performance	Age	Weekly wage	Occupation					
22		39		B.N.O.	4		73	32	340	Carpenter		73	26	£	Factory hand	73	73	73	Pneumonia measles	Paternal grandmother died of cancer at 46, macroglossia mongolian
23		29		N.	4		64	37	15	Butcher		73	33			69	64	73	No illnesses	Mongolian features, partial paralysis of tongue
24	42		42	N.	11		73	48	25	Garage		33	38			53	33	72	Measles, right hemiplegia	Paternal grandmother died of carcinoma uterii age unknown
25	63		50	N.	17		60	51	20	R. R. ganger		40	53			50	40	60	Whopping cough	1 brother and 1 sister subnormal
26	36			N.	13		70	32	38	Driver		50	32			60	50	70	Pneumonia, measles	
27	62		58	N.	10		48	34	40	Painter		60	34			54	48	60	No illnesses	Father's Wassermann positive
28		19		N.	11		73	33	20	Barber		47	30			60	47	73	No illnesses	Microcephalic
29	36			N.	14		87	42	30	Metal worker		73	38			80	73	87	No illnesses	Di-plegic

30	68			N.	6		50	33	13	Peddler		56	31		Factory hand	53	50	56	Pneumonia, scarlet fever, whooping cough	Maternal grandfather died at 50 epileptic
31	75		75	N.	10		50	38	46	Tailor	51	50	38	8	Janitress for rent	50	50	50	Scarlet fever, measles	
32		40		N.	7		74	45	55	Excavator		53	37			64	53	74	Measles, pneumonia, tonsilectomy	Maternal grandfather died at 63 of heart disease
33		19		N.	16		50	40	50	Butcher speculator		44	41			47	44	50	No illnesses	
34		26	35	N.	12		73	44	30	Porter		53	38			63	73	53	Measles, pneumonia	
35		24		N.	6		53	33	20	Baker		60	28			57	53	60	No illnesses	Microcephalic
36		9		N.	12		73	34	35	Salesman		40	32		Factory hand	57	40	73	No illnesses	
37		17		N.	15		81	45	40	Carpenter		43	38			62	43	81	No illnesses	
38		32		N.	8		42	65	20	Laborer		53	50	5	Factory hand	48	42	53	No illnesses	
39		46		N.	6		75	29	27	Laborer		40	24			58	40	75	No illnesses	Paraplegic
40		17		B.N.O.	4		73	49	40	Painter		50	40			62	50	73	No illnesses	Cyanosis at birth
41		11			17		80		35	Salesman		57	35			69	57	80	No illnesses	
42		11		N.	8		93	42	45	Salesman		60	37		Milliner	77	60	93	No illnesses	
43		9		N.	1		63	50	20	Longshoreman		50	40			57	50	63	Pneumonia whooping cough	Paternal uncle and 1 cousin hydrocephalic
44		67		N.	4	95	94	56	35	Male nurse	81	67	38		Housekeeper	81	67	94	Pneumonia, whooping cough	
45		27		N.	7		93	31	28	Book agent		66	31			80	66	93	Measles, whooping cough	1 paternal uncle probably feebleminded

The P.E. of the median is the measure of the unreliability of the ascertained median. It is derived from the formula

$$\frac{5}{4} \times \frac{Q}{\sqrt{N}}$$

The chances are even that the true median lies between the ascertained median ±1 P.E. There are 4.5 chances to 1 that the true median lies between the ascertained median ±2 P.E. There are 21 chances to 1 that the true median lies between the ascertained median ±3 P.E. Thus in the distribution for

TABLE 2

Children—Binet and Kuhlmann-Binet

*Q*1	19.3
Median	29.4
*Q*3	49.4
Q	15.5
P.E. of median	2.9

Fathers and mothers—Performance

	FATHERS	MOTHERS	FATHERS AND MOTHERS
*Q*1	60.9	49.1	51.6
Median	71.6	53.7	62.9
*Q*3	82.9	65.8	73.5
Q	11.0	8.49	11.0
P.E. of median	2.1	1.6	1.4

children there are nearly 21 chances to 1 that the true median lies between 29.4 − 8.7 and 29.4 + 8.7.

There is a general feeling among workers in psychological clinics that the performance scale does not adequately represent the mentality of adults and that feeling was very strong throughout this study. Moreover for the purposes of a comparative diagram, such as that presented it is necessary that both parents and children be placed on the same, or equivalent, scales. The most frequent correlations reported between the Binet and the Performance, are somewhere near

0.7 and on these it is evident that the Binet and the Performance are not parallel tests. It may also be seen from the tabulations that the ratings on the Binet Scale yield a higher average than those derived from the Performance, and the problem here is how to condition the Performance scores so that they may more or less represent scores on the Binet Scale.

We have 20 cases where the parents did both the Binet and the Performance, but we also see that of those who did a Performance Test alone, only 11 made scores of 80 or more. The remainder therefore made scores that fall in the borderline or subnormal groups. The writer was fortunate in being able, through the kind offices of Dr. Poull, to get the records of 57 subnormals, all adults over thirty years of age, drawn from the island population, who had had both Binet and Performance tests. If then we add these 57 subnormals to 19 of our parents, for it is advisable to exclude the mother of case 9, we shall have a group more or less representative of the parent group.[2]

We have then a group made up of 76 persons from whose median mental ages in months, the following set of data is derived:

	PERFORMANCE	BINET
*Q*1	72.6	86.0
Median	91.25	100.83
*Q*3	113.75	132.25
Q	20.6	23.25
P.E. of median	2.95	1.9

The difference between the two medians is 9.58 months, or roughly 9 months.

The correlation between the Binet scores and the differences between the Binet and the Performance scores is -0.46.

[2] The advisability of the above mentioned exclusion is based on two grounds: (1) That the individual in question is neurotic and unstable and at the time of the test was under great stress; and (2) she is younger than the average of the parents.

TABLE 3

CASE NUMBER	FATHER	MOTHER
1	78	58
2	88x	87x
3	75	82x
4	85x	91x
5	72	56
6	86x	85x
7	65	65
8	79	52
9	102	120x
10	94x	67x
11	65	45
12	81x	87x
13	45	52
14	65	45
15	52	98x
16	82	58
17	91	58
18	89x	69x
19	55	50
20	85	72
21	92x	86x
22	78	78
23	69	78
24	77	38
25	65	45
26	75	55
27	53	85
28	78	52
29	92	78
30	55	61
31	55	51x
32	79	58
33	55	49
34	78	58
35	58	65
36	78	45
37	86	48
38	47	58
39	80	45
40	78	55
41	85	62
42	98	65
43	70	55
44	95x	81x
45	98	71

(Those scores marked "x" are scores actually made by the parents.)

From this we may conclude that the error would not be very great if we did not raise the performance scores proportionately to their size. It is proposed, therefore, to add to the scores of the parents who did not have a Binet, nine months, or its equivalent in I.Q. based on fifteen years, i.e., 5.

The estimated and actual Binet scores of the parents will then be as shown in table 3.

When we take the scores made by the 19 parents in both Performance and Binet we have a small distribution from which the following data are derived:

	BINET	PERFORMANCE
Range	50.0–95	50.90
*Q*1	82.9	54.75
Median	87.9	66.88
*Q*3	90.42	86.25
Q	3.75	15.75
P.E. of median	1.1	4.5

Comparing these facts with those given in table 2 we see that we are dealing with the brighter members of the group of parents, and it would not be right to treat the Performance scores of the remaining parents according to the data derived from this group.

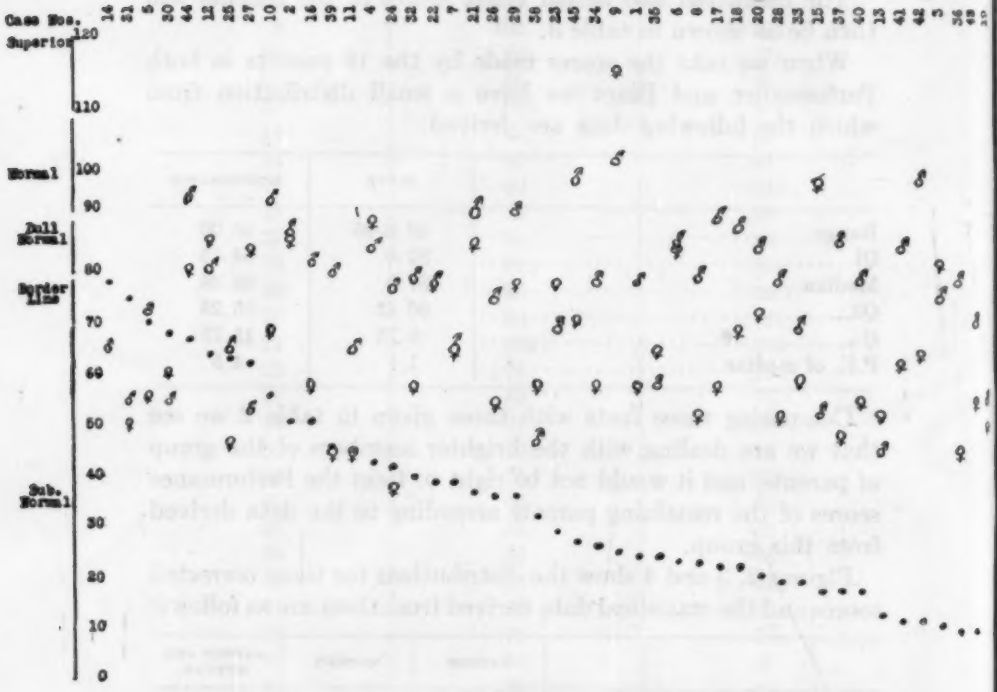
Figures 2, 3 and 4 show the distributions for these corrected scores and the statistical data derived from them are as follows:

	FATHER	MOTHER	FATHER AND MOTHER
*Q*1	67.3	54.3	57.2
Median	78	61.3	72.5
*Q*3	87.7	79.6	85.6
Q	10.2	12.7	14.2
P.E. of median	1.9	2.4	2.6
	AVERAGE	LOWER	HIGHER
*Q*1	60.3	51	70.6
Median	68.8	58	79.3
*Q*3	79.8	70.8	89.2
Q	9.8	9.9	9.3
P.E. of median	1.8	1.8	1.7

These are the data from which the diagram is compiled. Whereas the first set of data enabled us to study the cases individually, we are now able to study them as a whole.

DIAGRAM

Showing the relation of the I.Q. of the parents to that of the children.



The diagram shows the father (♂), mother (♀) and child (●) rated by the same scale, standing in their relative position. Frequent reference will be made to the diagram in developing the points that rise out of the data. It is proposed to discuss the data under the following three heads:

1. The relation between parents and children.
2. The fathers as a social group.
3. The mothers as a social group.

Children and parents

The relation between the social standing of parents and the mentality of their children, has been the subject of many researches. Terman (*Measurement of Intelligence*) found that the average I.Q. of children from a superior environment was 107, while that of children from an inferior environment was 93.

Bridges and Coler (Psych., Review, 1917) using the Poin Scale, showed that whereas the average mental age of children, whose parents could be rated as professional men was seven years ten months, with a corresponding coefficient of mental ability, of 112, the mental age of children whose fathers ranked as unskilled laborers was seven years one month with a corresponding coefficient of mental ability of 83. During the course of the study they tested five mothers of the latter class, who were found to have an average mental age of eight years. Occupations ranking between these extremes showed a corresponding increase or decrease in the average mental ages of the children.

Kornhauser found the approximate correlation between the social status of the parents, as indicated by their having a telephone or not, and the school achievement of the children to be 0.61.

Pressey and Ralston found that 85 per cent of the children of professional men made scores above the median of the group of which they formed a part; for the children of executives and independent tradesmen the percentage was 68; for the artisan class 41 and the laboring class 39 (Jour. App. Psych., 1919). In the same number of the same journal is mentioned a study by Pressey and Thomas, which shows that the children in a good farming district average above children in the poor district.

Such studies as these may be regarded from two points of view; they may be looked upon as emphasizing the influence of environment on the mentality of the children, or the environment itself may be regarded as the outcome of the mentality

of the parents, which is transmitted to the next generation. On the basis of these studies therefore, it was to be anticipated that the parents of this study would be a group occupying an inferior position in the social scale; but how they compare with other groups occupying the same status will be shown later on.

The children in this study form an interesting group especially with reference to their relation to their parents, as shown in the diagram. Their relative positions as charted there would hardly lead one to expect a high correlation between children and parents. The diagram shows the parents to be arrayed in a horizontal line, while the children form a diagonal with a drift quite away from the line of the parents. Worked out according to the Spearman method of rank differences they are as follows:

	ρ	r	P.E.
1. Between children and parents on the Performance Scale			
Children and fathers.....	−0.047(−0.05)	−0.05	0.105
Children and mothers....	0.09 (0.1)	0.10	0.105
Children and average.....	0.007(0.01)	0.05	0.105
Children and lower.....	0.032(0.03)	0.03	0.106
Children and higher.....	−0.037(−0.04)	−0.04	0.106
Fathers and incomes.....	0.140(0.14)	0.15	0.105
2. Between children and parents, on Binet, actual or estimated			
Children and fathers.....	−0.029(−0.03)	−0.03	0.106
Children and mothers....	0.102(0.1)	0.10	0.105
Children and average....	0.025(0.03)	0.03	0.106
Children and lower.....	0.166(0.2)	0.18	0.102
Children and higher.....	−0.046(−0.05)	0.05	0.105
Fathers and incomes.....	0.135(0.14)	0.15	0.102

To explain these correlations, it would be as well to summarize the facts with reference to both children and parents.

1. The Island population is drawn from various sources. Some are court and conduct cases; some come from the un-

graded classes of the schools, while the large majority are voluntary commitments by the parents. Since numbers of feebleminded children never come within the scope of the jurisdiction of the State, we know that the children of the study do not represent the whole population of feebleminded children, though they represent this population to a greater extent than they represent the whole population of all children.

2. There have been unavoidable selective influences as explained in section I.

3. With reference to the parents, the selective influence of the institution has given us a sample of a class of parents who through poverty, lack of feeling, or incompetence cannot provide for their children without the help of the State.

To come into line with biometrical studies, it would be necessary to have a number of cases that cover the whole range.

The correlations as here obtained must be explained by the fact that we are dealing with a segment of the whole table which lowers the correlation, as shown by Boas (Jour. Amer. Statis. Assoc., June, 1921.)

Since we have only the record of one child of the family, we cannot prove whether the law of filial regression would hold in these cases, nor whether children tend to vary around the mean of their parents. It is probable, however, that in many of these cases we have the lowest child of the family, and that the siblings will range from positions above the parents (not impossible as shown by the few cases in the diagram) down to the child here represented. It is probable that the average of the children will, for this reason, come into closer relation with the line of the parents, but whether the correlation will be any higher cannot be affirmed on this speculative basis.

We are, however, faced with the fact that parents of this type do have a child very much lower in mentality than they themselves are. The study certainly tends to show that the population of institutions for the feebleminded is drawn more from the borderline and moron elements of the population than from the grossly subnormal elements.

We have no data with reference to children from private institutions, but even if such parents were found to be of higher mentality than the parents who figure in this study it would still remain to be proved that they are not the carriers of an hereditary taint.

Another interesting fact shown by the diagram is that with one exception there are no parents in the very low grades. Does this tend to show that persons low in the grade for subnormality do not mate; or that they have no offspring; or if they have, that such offspring is not subnormal; or that they do not bring their subnormal offspring to institutions for the feebleminded; or that the children die because the parents have not sufficient intelligence to take proper care of them? It is surely to be expected that if parents of the type that figures in the study, bring a child to an institution, those of lower mentality driven by economic stress would do the same. There are numerous instances of both parents and offspring being inmates of institutions for the feebleminded, and this fact coupled with the possibility that low grade potential parents have already been drafted into institutions, would account for the absence of parents in the lowest grades.

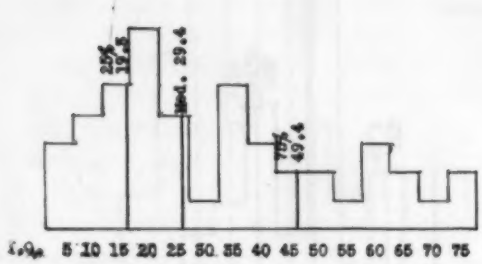
Fathers and occupations

The occupations of the fathers show a fair variety, though it will be noticed that with a few exceptions, there are not many occupations where initiative or the ability to take responsibility is required. Most of them are tradesmen or factory hands; there are a few laborers and a few who described themselves as commission agents, though they are really jobbers.

The correlations between incomes and intelligence is 0.14. This may be due to several factors:

1. Restricted range.
2. The fact that such a correlation except on the broadest lines does not exist.
3. The high wages paid to unskilled labor in this country.

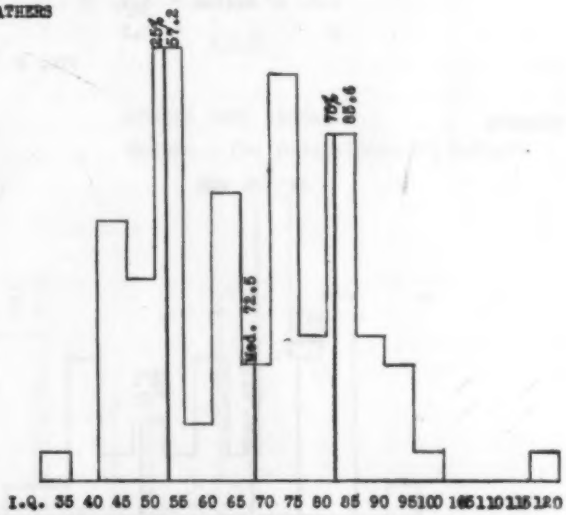
CHILDREN



P.E. of Median = 2.9
Q = 15.5

FIG. 1.

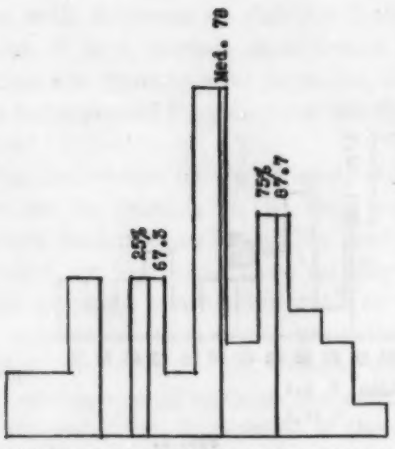
MOTHERS and FATHERS



P.E. of Median = 2.6
Q = 14.2

FIG. 2

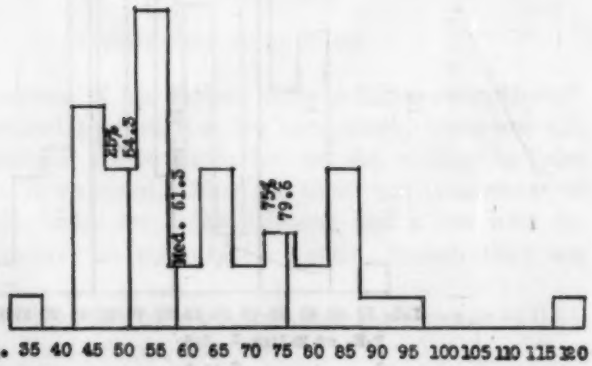
FATHERS



P.E. of Median = 1.9
Q = 10.2

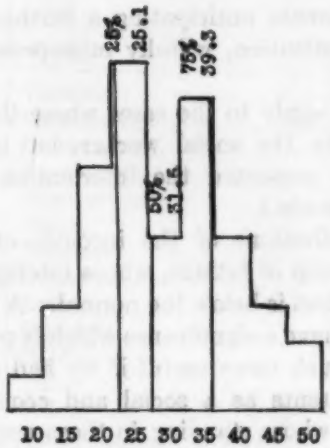
FIG. 3

MOTHERS



P.E. of Median = 2.4
Q = 12.7

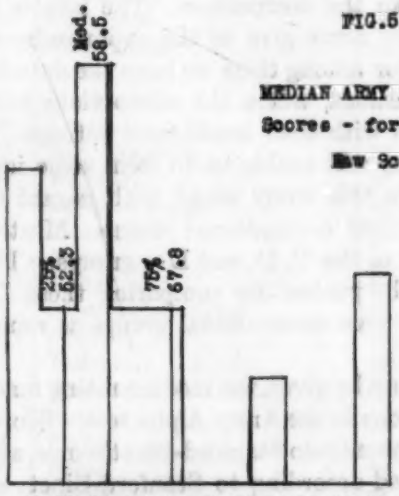
FIG. 4



FATHERS INCOMES
(Weekly wage in dollars)

P.E. of Median = 1.3
= 7.1

FIG.5



MEDIAN ARMY ALPHA
Scores - for Occupations of Fathers
Raw Scores

P.E. of Median = 1.5
Q = 7.8

FIG.6

4. The possibility that parents anticipating a further call on their purses from the institution, wilfully misrepresented their earning capacity.

(This does not, of course, apply to the cases where the incomes have been checked by the social worker; but in the majority of the cases here presented the information was derived directly from the parents.)

Figure 5 shows the distributions of the incomes of the fathers. We have here a group of fathers, whose intelligence measured by a standardized test is below the normal. A mere statement to this effect may have a significance which is purely academical. It would be much more useful if we had some way of comparing these parents as a social and economic group, with another group whose standing in these respects has already been ascertained. The problem would be met if we had some occupational group corresponding to the parent group with which to make the comparison. The results of psychological testing in the army give us the opportunity to form such a comparison for among them we have the data for a group, of similar occupations, where the occupations have been brought into relation with their intelligence ratings. A comparison with this group will enable us to form some idea as to where the parents in this study stand with regard to intelligence in relation to their occupational status. Most of the cases studied here fall in the C, D, and D− groups. The comparison can however be pushed by comparing these fathers individually to their own occupational groups as represented in the Army.

To do this the fathers may be given the median rating made by men of similar occupations in the Army Alpha test. Scores in the Alpha can be transposed into Stanford-Binet scores, and as we have our parents rated according to Stanford-Binet, we shall be in a position to compare the actual ratings as arrived at in this study to what should have been the rating made by the fathers if they possessed the median intelligence of other men following the same occupations. Where the occupation of a parent is not listed in the Army returns, we may rate his more or less by comparison. Thus a tinsmith, plumber and

TABLE 4

CASE NUMBER	OCCUPATION	MEDIAN ARMY ALPHA RATING	STANFORD-BINET MENTAL AGE	I.Q.	I.Q. BY TABLE 3	POSITION BY ARMY QUARTILES
1	Varnisher	58.7	13.5	90	78	1
2	Laborer	46.7	13	86	88	2
3	Cutter	62.8	14	93	75	1
4	Paper-cutter	62.8	14	93	85	2
5	Window-washer	46.7	13	86	72	1
6	Baker	58.7	13.5	90	86	2
7	Farmhand	48.3	13	86	65	1
8	Grocer's agent	95.8	16	106	79	1
9	Tailor	53.3	13.5	90	102	4
10	Foreman	80.4	15	100	94	2
11	Peddler	56.3	13.5	90	65	1
12	Tailor	53.3	13.5	90	81	2
13	Peddler	56.3	13.5	90	45	1
14	Tinsmith	66.3	14	93	65	1
15	Presser	62.8	14	93	52	1
16	Shoemaker	56.3	13.5	90	82	1
17	Mechanic	68.5	14.5	96	91	2
18	Carpenter	59.8	13.5	90	89	2
19	Time keeper	80.4	15	100	55	1
20	Tailor	53.3	13.5	90	85	2
21	Mechanic	68.5	14.5	96	92	2
22	Carpenter	59.8	13.5	90	78	1
23	Auto mechanic	66.4	14	93	69	1
24	Butcher	61.4	14	93	77	1
25	Railroad ganger	46.7	13	86	65	1
26	Teamster	49.7	13	86	75	1
27	Painter	58.7	13.5	93	53	1
28	Barber	54.6	13.5	90	78	1
29	Sheet-metal worker	66.2	14	93	92	2
30	Peddler	56.3	13.5	90	55	1
31	Tailor	53.3	13.5	90	55	1
32	Foreman	80.4	15	100	79	1
33	Butcher	61.4	14	93	55	1
34	Porter	46.7	13	86	78	2
35	Baker	58.7	13.5	90	58	1
36	Salesman	95.8	16	106	78	1
37	Carpenter	59.8	13.5	90	86	2
38	Laborer	46.7	13	86	47	1
39	Laborer	46.7	13	86	80	2
40	Painter	58.7	13.5	90	78	1
41	Salesman	95.8	16	106	85	1
42	Salesman	95.8	16	106	98	2
43	Longshoreman	46.7	13	86	70	1
44	Male nurse	95.8	13.5	90	95	2
45	Book agent	95.8	13.5	90	98	2
Averages		63.4	14	93	73.5	

sheet metal worker might be rated the same, while a commission agent might be compared to a general clerk.

Table 4 shows the occupations of the fathers with the Median Army rating in the Alpha for that or an analogous occupation. It also shows the median rating transposed into Stanford-Binet mental ages, the corresponding I.Q. and the actual or estimated I.Q. as arrived at earlier in the study (table 3). The last column shows the standing of the fathers with reference to the quartiles of the Army groups.

The following occupations were estimated:

OCCUPATION	RATED AS
Varnisher	Painter
Cutter Paper cutter Presser	General Machinist
Salesman Book agent Male nurse	General Clerk
Window washer Ganger Porter	Laborer
Time keeper Foreman	Concrete construction foreman
Tinsmith Sheet metal worker	Plumber
Peddler	Shoemaker

Figure 6 shows the distribution of the Median Army Alpha scores for the occupations of the fathers. A comparison of the third and fourth columns of table 4 shows that with very few exceptions the fathers individually fall below the median rating for their professions, as determined by the Army groups. The average difference in I.Q. is nearly 20. The last column

of the tabulation shows which quartile of the group these fathers would have fallen into by virture of the I.Q.

The raw scores as distributed in figure 6, range from 45 to 100 with a corresponding range in I.Q. of 83 to 110. On the other hand the I.Q.'s of the fathers according to figure 3 range from 45 to 105. This comparison is further borne out when we put the essential data for the distributions side by side.

	FIGURE 6	CORRESPONDING I.Q.	FIGURE 3
$Q1$	52.3	86	67.3
Median	58.5	90	78.0
$Q3$	67.8	93	87.7

Taking $Q1$ as marking off the lowest 25 per cent, we see that 75 per cent of the fathers just come up to the score that would have marked off the lowest 25 per cent of them if they had been on a par with the Army groups.

Figure 6 would tend to show that some of the fathers have been rated somewhat too highly, but there is enough evidence to show that the parent group is low in intelligence when compared to groups pursuing similar occupations. Of the mothers 11 pursued or are pursuing some industrial occupation the findings here being so small as to need no further mention.

The mothers

When we come to consider the case of the mothers in this study, we find a very interesting set of facts. While they have a slightly wider range than the fathers, their median is 61.3 while that for the fathers is 78. It is possible that this indicates a sex difference with reference to the Performance test, though such a difference is not commented on by the authorities who standardized the test.

When the reliability of the differences between the two medians is worked out by formula

$$\text{P.E. Diff.} = \sqrt{(\text{P.E. Med.}_x)^2 + (\text{P.E. Med.}_y)^2}$$

we get a result of 6.88, or practically 7.

Most statistical authorities agree that a difference should be at least four times the P.E. of the difference if it is to be regarded as significant, and in view of the fact that the difference arrived at here is almost 7 times the P.E. we may conclude that it is significant.

There seem to be two ways of explaining this difference:

1. That there actually is a sex difference in the Performance test.

2. That there is an actual difference in the mentality of this type of mother as contrasted with this type of father.

As regards point 1 there is no confirmation from other sources that a sex difference exists, and until such a confirmation is forthcoming, this interpretation of the difference must be discarded. On the other hand, observation during the collection of the data, created the impression that the difference is to be explained under the second heading, and this impression is amply fortified by the experience of the social workers of the institution. According to them, an intelligent mother who has the earnings of a husband of lower mentality than her own to fall back on, can generally manage to provide for a mentally deficient child, and the social workers practically never oppose a discharge in such a case, unless there are other complicating factors. When, however, the mother is low grade, they find her unable to control the other children or to preserve even a semblance of order and cleanliness in the house. In such cases they vigorously oppose an application for discharge, and experience has taught that a very short time elapses between discharge and an application for readmission.

Eliminating then the conclusions that all mothers are of lower intelligence than their husbands, and that all mothers of feebleminded children are of lower mentality than their husbands, it seems safe to conclude that in the cases of children who are inmates of institutions for the feebleminded, there is every likelihood that the mothers will be lower mentally than are the fathers. It seems then that the institution, besides selecting from an inferior social group, and from fathers whose intelligence is low for their occupational group, is also selective

of incompetent mothers. Certainly we may say that in a biological sense the mothers in this group are parasitic, since if they did not have the earning capacity of the fathers behind them, they could not survive in the struggle and would eventually have disappeared or drifted to some state institution.

These findings together with those from other sources that emphasize the relation between deficiency and delinquency (Miner, *Deficiency and Delinquency*) constitute a strong plea for a rigid supervision of cases paroled from institutions for feebleminded women, as well as of degenerate or cacogenical marriages (Wallin, *Problems of Subnormality*).

Except from the point of view of mentality, where the comparison is close, the women in this study are hardly comparable to those studied in connection with delinquency and criminality. They are presumably moral, and possibly an element of stability lacking in the other cases keeps them from contact with the law. Possibly too, the regulative effect of marriage, with all its social implications for this class, may have the effect of inhibiting tendencies that would have been brought into play if they had remained single.

Conclusions drawn from this section

1. That the fathers of this study form a social group of low intelligence when compared with a group whose occupations are similar.
2. That the mothers of the group are even lower than the fathers.
3. That the typical family sending a child to a public institution for the feebleminded is of medium occupational status; the average I.Q. of the father being approximately 73, rating low for his occupational group, while that of the mother is still lower, being approximately 64.

IV. RELATION OF THE DATA TO CAUSES OF FEEBLEMINDEDNESS

So far the data have been considered from the point of view of their clinical and sociological bearings. Since how-

ever the study concerns itself with primary aments, it is necessary to state the position with reference to the causes of amentia and to show the relation of the data to these causes.

Faced with the teachings of biology, it seems logical to conclude that the individual begins its existence from the time of the fertilization of the female ovum by the male sperm, and from this point of view the factors causing amentia may be regarded as being operative at three different but successive stages:

1. Before fertilization
2. During fertilization
3. After fertilization

1. Postulates some defect in the germ plasm of one or both of the parents, such defect being either native or acquired;

2. Postulates in addition the possibility of the union of unsuited germ plasms, such as would be the case in consanguineous marriages;

3. Postulates some toxic or traumatic agent that affects the fetus to its detriment.

Walter in his *Genetics* gives the following convenient classification of conditions that may influence the germ plasm of parents to the extent of causing variations harmful or otherwise in the offspring: (*a*) mutilations; (*b*) environmental effects; (*c*) use and disuse; (*d*) disease. It is with the last of these that we are concerned. Taking this in connection with what has been said before we may tabulate the causes of amentia in the following manner:

1. Before fertilization:
   - Neuropathic ancestry
   - Diseases of parents
   - Alcoholism of parents
   - Syphilitic condition of parents
   - Toxic condition of parents owing to occupation (industrial poisoning)
2. During fertilization:
   - Consanguinity
   - Disparity in ages of parents
   - Old age of parents at conception

3. After fertilization:
   Injury to fetus due to toxic or traumatic factors
   Mental state of mother
   Primogeniture
   Premature birth
   Abnormalities of labor

The position taken in this study is that only in the presence of factors operating under 1 and 2 can we properly speak of primary amentia; and that in the case of factors operating after fertilization we are really dealing with cases of secondary amentia. The writer is well aware that this is in the nature of a *reductio ad absurdum*, in that it makes it impossible to decide whether a case is one of primary or secondary amentia. It is however respectfully submitted, that where one parent, or both parents, is or are proved to be subnormal, by a test which has been standardized and well established, we have every justification for concluding that such parents are capable of transmitting defective germ plasm, and that it is illogical and unnecessary to regard other factors as causal when this has been proved.

It may be as well, before beginning a discussion of these points in detail, to clear the board as far as the common infantile diseases are concerned. There may yet be people who think that such illnesses as measles, whooping-cough, etc., may cause feeblemindedness. It is difficult to see how they arrive at this position in the face of the number of clearly authenticated cases to the contrary. It lies in the experience of every observer to bring forward cases of children who, though they have had these diseases, have suffered no impairment of their mental capacities. Similarly many people are of opinion that pneumonia is a cause of amentia. The popularly known "Spanish influenza" was to a large extent succeeded by or complicated by pneumonia, this being the most fruitful cause of death. Numbers, however, survived, and if pneumonia causes feeblemindedness, then there must have been a great increase in the number of ments in the years immediately succeeding the visitation. Such an increase must

have been of alarming proportions, yet not only has it attracted no attention up to the present, but inquiry has failed to show that the increase has been abnormal. In these 45 cases we have 20 children who have had no illnesses, while some of the remainder have had one or two of the diseases of childhood and some have had something graver. The position is most probably best summarized by Tredgold, who says, "Amentia is rarely caused by injurious factors operating alone." In his view the prerequisite is what he calls a "neuropathic diathesis," which means that the offspring are the outcome of germ plasm already tainted.

Many present day biologists do not think that any of the factors cited under 1, can be regarded as having any effect on offspring. They claim for the germ plasm an inviolability to the effects of environment that enables it to transmit the parental characteristics, other than those acquired, unimpaired and unmodified. It must in all fairness be said, however, that all biologists do not hold this view, and that a very fair case based on the close relation of epithelial tissue and germ cell can be made out, is shown in a brief but pungent essay by Morley Roberts in *Warfare in the Human Body*. The chief protangonists of this point of view are Kammerer, MacBride, and Guyer. Moreover in Science (June 16, 1922) Conklin is quoted as supporting the view that chromosomes and cytoplasm are environments to each other and that it is impossible to assume that all factors for heredity and differentiation are located in the chromosomes.

Alcohol

The important part played by heredity or the neuropathic diathesis in amentia has already been discussed in section II and it is proposed to go on to the consideration of alcohol as a cause of germinal variation harmful to the offspring.

Besides syphilis, there is no subject which has been so much disputed, and each side seems to be able to bring figures in confirmation of its own point of view. Most of the evidence adduced in this case, as well as for other factors, has been

reviewed by Holmes in *The Trend of the Race*, where he points out that the experiments of Stockard can be paralleled by those of Pearl and Torelle. Tredgold says that 46.5 of his cases showed a family history of alcoholism but adds that in five-sixths of these there were evidences of neuropathic ancestry, and that the remainder showed a history of some other morbid influence. The authorities he cites show such discrepancies that we should be careful of accepting a point of view that may be more partisan than an unbiased expression of opinion. Everyday observation will give us many cases of mental deficiency in children where the parents were alcoholic, but it will also give us cases where, the same condition pertaining in the parents, the children showed no signs of degeneracy in mental traits. There are no figures to show that the percentage of the feebleminded in nations that habitually use alcohol, is greater than that of those who use it to a lesser degree. It is not denied that such nations may have immunized themselves to the effects, and the devastation caused by alcohol among savage tribes previously unacquainted with it are often quoted, with how much justification it is difficult to say. On the other hand the Scotch people are quoted by Pearce Baily (Mental Hygiene, 1920–1924) as being more addicted to the use of alcohol than the American or English peoples. At the same time according to the same authority the Scotch show a smaller percentage of feebleminded than either of the two other nations mentioned.

It seems then that the mere record of alcoholic tendency is not enough to explain the matter of mental deficiency. Tredgold thinks that the discrepancies between the authorities whose figures he quotes, may be explained by regarding alcohol as contributory rather than causal, and Goddard says he can find no conclusive evidence from his charts that the condition of the child in question was due to the use of alcohol by one or both of its parents. It seems that more time has been spent in finding out what alcoholism causes than what causes alcoholism.

Alcoholism is more common among feebleminded persons and those of inferior neuropathic constitutions. This contention is abundantly borne out by the returns from prisons and reformatories, and this fact, together with the incidence of alcoholism in families where there is definitely marked feeblemindedness, seems to point to the conclusion that, instead of alcohol causing feeblemindedness, it is really one of the consequences of that condition. American investigators, however, will have opportunities in the following years of testing this popular theory. Unless the illicit sale of liquor manages to reach the same proportions as the legalized sale before prohibition, then there should be a marked decrease in the returns for feeblemindedness in the generation following the passage of this measure.

Syphilis

Another cause popularly regarded as being a fruitful cause of amentia is the syphilitic condition of one or more of the parents. Here again we are faced with as many contradictory arrays of facts as we were in the case of alcohol. That syphilis is, in the ordinary sense of the word, hereditary seems hardly possible when we remember that the implication is that there is a possibility of the offspring inheriting a disease germ. On the other hand, if in spite of the fact that the placenta is a fairly impregnable filter, the germs can pass through the chorion cells and affect the offspring, there is no way of proving that such offspring was not feebleminded before being infected. Nevertheless, here again cases of syphilitic parents with normal offspring can be brought forward to offset cases where syphilitic parents have feebleminded children. There are also authentic cases where the father becoming infected and the infection having been transferred to the mother after pregnancy, the offspring remained unaffected. Furthermore this has been noticed to happen both before and after the formation of the chorion cells.

The facts then seem to be of such a nature as to make the assumption on priori grounds, that the syphilitic condition

of one or both of the parents causes mental deficiency in the offspring unwarrantable.

It was hoped at the beginning of this study that it would be possible to get a Wassermann of each of the parents. It was even predicted that it would be easier to get the parents to submit to the Wassermann than to psychological examination. Experience proved the contrary to be the case. Very little difficulty was encountered in persuading them to take the test, whereas the request for a Wassermann was met by refusals ranging in character from the hysterical to the indignant. As there was no machinery for enforcing the taking of this test, the project had to be abandoned not however, before a certain number had been taken. There is a general impression that those parents who made higher scores looked at the matter from a much more sensible standpoint and were in some cases eager to have the test taken. It must be noted in this connection that the absence of a positive Wassermann is no proof that the person giving this reaction is not syphilitic, and on the other hand nobody who has had great experience in working with the test would hesitate to acknowledge that the positive reaction must be regarded as symptomatic rather than as irrefutable proof. The percentage of syphilitics in the normal population is 10 (Dublin and Clark, Social Hygiene, October, 1921) though this most probably includes cases that would not from the clinical point of view be regarded as syphilitic. The register on Randall's Island shows the percentage among aments to be 4. There is no reason to believe that, except so far as the number is restricted and may in this way give a higher percentage, the actual percentage for parents or patients would be much higher than the figures quoted.

Of the children who figure in this study, none of those who were tested has a positive Wassermann; of the 24 parents who were tested, 2 gave positive reactions. It is here again significant that in Goddard's study the larger percentage of cases where there was a syphilitic condition in one or both of the parents fell in the hereditary group. Tredgold too thinks that the result is largely influenced by the presence or absence

of neuropathic taint. Though we must admit the possibility of offspring being infected in utero, and the further possibility that such infection may go to the extent of causing impairment of mental functions, yet we cannot say that the syphilitic condition of one or both parents *ipso facto* causes feeblemindedness in offspring. The syphilitic poison, says Tredgold, "seems to have the predilection for finding out the weak spot, and if a predisposition to nervous weakness exists, the chance of the child of syphilitic parents being mentally deficient seems to me to be very considerable; in the absence of such it may possibly escape." Goddard says, "A glance at the distribution of the syphilitic cases shows that there is little evidence that syphilis is a cause of feeblemindedness."

Tuberculosis

Tuberculosis with other morbid conditions of the parents has frequently been considered one of the causes of amentia in offspring, but it is quite evident that such an opinion rests on a very slight basis. History offers many cases of persons who have been brilliant intellectually although they were tuberculous, and there are numerous instances where such people have had normal or even intellectually superior children. Goddard's charts show that the cases of tuberculosis found in his study, when charted, can only be accounted for by contagion. Tredgold's evidence is less positive in that he thinks that it may have an important influence though indirect and contributory. These indirect effects, however, are seen to be not characteristic of amentia, either primary or secondary. It seems much more likely that the feebleminded who are incapable of exercising proper care over themselves should contract tuberculosis, and that here also there has been a confusion between cause and effect.

Goddard has further data as regards paralysis, epilepsy, etc., and finds nothing to prove that these are causes of amentia in the absence of heredity.

There is a possibility, though a very slight one, that in certain industries where the parents are exposed to toxic

conditions, the poison absorbed into their systems may be harmful to their offspring. The data on this point seem to be very slight and loosely worked up and by no means of a nature to justify the formation of a definite opinion.

Consanguinity

The most important of the causes of feeblemindedness under the second heading is consanguinity, which has for a long time been regarded as a prime factor operating to produce that condition. That there is nothing to substantiate this is evident from the works of both Tredgold and Goddard. The latter takes each case of consanguinity as it occurs in his charts and finds only one case in which the parents, though normal, were cousins and had two feebleminded children. Here however, the mentality of the grandparents had not been determined.

In only two of the many cases reviewed as possible subjects for this study were the parents related. In one there were two children, both microcephalic; in the other comprising also two children both were aments but not suitable for this study on other grounds than those just mentioned above. In the first case, the two children were the result of three possible pregnancies, the mother having menstruated only once between the two pregnancies. However, the mother's sister had also married her cousin, a brother of the father in the case under consideration, and the children of this union were according to report perfectly normal. The normality of these children may have been exaggerated, but at least they did not attract attention.

Far from consanguinity being regarded as a cause of amentia, it is an open question from the point of view of some geneticists whether judicious inbreeding might not make for improvement. It is highly probable that a mating of two persons of neuropathic taint increases the possibility of the defect appearing, since the child is the result of the union of germ plasms which in their union double the factors causing the defect, but that consanguinity in itself causes mental deficiency

does not upon the strength of the evidence offered appear likely. Similarly the contention that old age of the parents or disparity in their ages at the time of conception causes feeblemindedness rests on a very slight basis. Equally insignificant is the contention that primogeniture or order of birth has any effect on the mentality of the children.

Looking at the data on page 103 we see in the table for the lower scores that 75 per cent of the parents have I.Q.'s falling below 70.8. The discussion has emphasized the inferior standing, intellectually and socially, of the group and the excessive inferiority of the mothers. What conclusion is then to be drawn from these facts? Is the subnormality of the children to be attributed to environmental effects, or hereditary influences, or to both? The simple explanation of heredity is sufficient to account for physical feature. Why should that explanation not serve here? It is true that because of selective influences no general deductions can be made as to heredity and mental deficiency from the data collected for this study. At the same time there is a strong suspicion, based on these findings, that for this type of the general population the heredity influence is the prime causal factor.

CONCLUSIONS

1. The children selected for this study are a fair sample of mental defectives committed to a public institution.

2. Of the 45 cases figuring in this study, selected as being admissible to a public institution and as having no history of epilepsy nor convulsions, 33 or 73.3 per cent have one or both parents who are themselves below the borderline. These may be classified as cases of primary amentia in which immediate heredity is an important factor.

3. Of these mentally defective parents, 30 were mothers 13 were fathers and in 11 cases both father and mother were defective.

4. The mothers are on the whole lower than the fathers (71 per cent of them being actually below the fathers) and

the difference between the medians is significant of a real difference in mentality between these fathers and mothers.

5. Three of the children tested are brighter than their parents; 8 lie midway between their parents; and of the remaining 30, 4 are lower than their parents.

6. The fathers form a group relatively low in intelligence for their occupational status.

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THREE CHILDREN OF SUPERIOR INTELLIGENCE AND INFERIOR MOTOR ACHIEVEMENT[1]

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The three children to be described in this article were all characterized by superior intelligence and inferior motor achievement.[2]

The first two typify many a gifted child who because of precocious book learning alone has been launched upon his entrance into school into a relatively advanced grade, where he meets with children who have had the opportunity for well-rounded development in all the subjects of the school curriculum. At the time of psychological examination, John, not yet seven years old, was in the third grade; and Mary, six years old, in the second. Their mental ages, as reflected in their respective intelligence quotients of 140 and 158, were nine years, eight months, and ten years, two months, respectively. Their intellectual work was satisfactory,—both were leaders in the literary life of the grade in which their academic achievement had placed them,—but they were inferior in motor activities. Thus, though their days in school were still so few, the incentive to improve which would come from success in mechanical work seemed already denied. Their cases raise the problem whether a child because of unusual talent manifested in one group of subjects should be

[1] This manuscript was received for publication from Miss Chassell while she was Instructor in Psychology, Ohio State University, Columbus, Ohio.

[2] For the records in the psychological examination and for general coöperation in the study, the writer is indebted to Clara F. Chassell, School Psychologist of the Horace Mann School, Teachers College, New York City.

automatically deprived of rudimentary training in those subjects in which he has not yet had experience, and which under favorable circumstances he may therefore never have opportunity to attempt.

The third child typifies the mentally gifted pupil who has no talent for tasks of the hand, and, despite every opportunity from early childhood up, remains inept in motor activities. At the time of psychological examination James was eight years old; unlike John and Mary, he had, except for skipping one-half year's work, progressed regularly in school, beginning with the kindergarten, and was then in the third advanced grade. His mental age was twelve years, one month, and his intelligence quotient, 149. He, too, did good book work, but he was the despair of his industrial arts teacher. His case raises the new-old problem whether a child should be required year after year to persist in a school subject from which he seems by nature denied benefit, and through which he is trained in habits of wastefulness of time, effort, and materials, and in expectation of failure.

We shall consider each of the children in turn, indicating the particular problem which occasioned the study, the procedure followed in its solution, and the results of the investigation.

Because of marked inferiority in writing, John was referred for psychological examination by his teacher, who wished to be advised regarding penmanship methods. An illustration of his extreme backwardness in this subject is the fact that when subsequently tested he consumed nearly two minutes in drawing, "See the liittle boy," the product measuring 9 on the Thorndike handwriting scale.[3] Early tests given by the school psychologist, including the individual intelligence test, performance tests, and tests for right- and left-handedness, indicated high intelligence, but suggested no clue to his difficulty. A subsequent interview with grade teacher or mother, however, gave a probable explanation.

[3] The rate was thus only about one-half that which would be required of an average eight-year-old, though the quality was satisfactory.

He had never before studied writing though in the third grade, having been placed there upon his first entrance to school, only two weeks previous to his reference for psychological examination, because of his proficiency in academic subjects. Yet it was not possible to predict to what extent he would profit from instruction in handwriting. Further investigation of his motor capacity and special lessons in penmanship seemed advisable, and his case was referred to the writer.

Problems which seemed worthy of investigation were the following: Did he have some motor disability which would be revealed by motor tests or by his school work in motor subjects? Did he use the less skillful of the two hands in writing? Was he immature in physiological development or did he have some special physical defect? Looking toward the solution of these problems, further tests of the same general character as those already used were given and in addition handwriting and physical tests; the grade teacher, the special teachers, and the mother were interviewed; the school records of his physical examination were referred to; and special writing lessons were given.

Omitting the handwriting tests, which are to be reported later, the collective results of these tests considered together with those previously given by the school psychologist, pointed to normal motor and physical development, as did the results of the larger number of the tests considered singly. They therefore do not warrant detailed quotation here.[4] The tests for right- and left-handedness, though possibly indicating an original preference for the left hand,[5] pointed to ambidexterity at the time of the examination; they thus did not furnish sufficient justification for a shift from the right to the left hand.

Interviews with the teachers indicated a less satisfactory condition. Though his academic work, particularly his

[4] The results of these tests and of similar ones for the other children studied are given in the appendix of a more extended form of this article, on file in the Horace Mann School.

[5] That such a preference actually existed in babyhood was later confirmed by the mother.

reading, was satisfactory,[6] his school work involving motor control was inferior. In gymnastic exercises he was reported as being rather stiff and slow though having a good sense of rhythm; and in art as doing beautiful brush work at the outset but never accomplishing a finished product. Handwork was stated to be the most unsatisfactory phase of his school work by his grade teacher. However, none of the shortcomings in the motor work appealed to the teachers as serious.

Reference to the records of the physical examination brought out the fact that he had nystagmus, which might lead to slowness in reaction, and vision which was still somewhat defective, though an attempt had been made to correct it with glasses; also, that he exhibited doubtful evidences of chorea in a mild form.

Most significant of all the data secured, however, were those relating to his improvability in handwriting. It was clearly demonstrated by his response to the writing lessons, seriously interfered with though they were because of a complication of circumstances, and by his progress in penmanship during the succeeding days in school. Both of these were measured by the handwriting tests previously referred to. To be compared with the specimen, "See the liittle boy," requiring for its laborious execution approximately two minutes and measuring quality 9, is the specimen secured some two months later; though almost seven times the length of the first, it was written in perhaps four times the time, averaging fourteen letters a minute, and measured very nearly quality 11. As compared with the second specimen, a third, identical in content, written a month later, showed a gain of slightly

[6] His work in reading was said to be very superior. Frequently he would dramatize a book he had read and impersonate the characters. He was gifted as a story teller. Both unusual home training and unusual heredity were responsible for his literary precocity. His mother began his instruction when he was but one year old. At eighteen months of age he knew all the letters of the alphabet; and when not over two and one-half or three years old, would pick out letters in car signs and newspapers. His maternal grandfather was a writer and a member of the Authors' Club.

over two and one-half letters a minute, and would undoubtedly measure quality 11. His progress in school was also indicated by a second report from his teacher to the effect that he was then able to keep up with the other children.[7] Moreover, having once been given a fair start, he took great interest in penmanship according to the report of the mother (who was planning to continue the special lessons), and spent considerable time practising. Thus with a very limited amount of training he was able to hold his own and was even finding the subject attractive.

To be compared with this outcome is that in motor subjects in which he was not given special help. In these, although the examination had shown him to have no innate motor handicap, he continued to be backward, being reported as below average at the close of the second quarter in fine arts and industrial arts, and during the following semester in physical education, fine arts, and industrial arts; also, during the following school year[8] (until the fourth quarter when because of leaving school he vanished from observation) as below average for one quarter in industrial arts and for all quarters in physical education.[9]

[7] His improvement was clearly reflected on his report card. At the end of the first quarter his penmanship grade was "fair"; at the end of the second, "good"; and at the end of the third and of the fourth, "excellent."

[8] When a new system of reports was adopted which made special mention of subjects in which the pupil was above or below average, those that showed particular improvement, and those in which the child apparently was not working to the best of his ability. See, "A scale for measuring the importance of habits of good citizenship (with description of its use in a new report card at the Horace Mann School)," by Siegried Maia Upton and Clara Frances Chassell, reprinted from Teachers College Record, vol. xx, no. 1, January, 1919.

[9] John was still below average in "system" at the close of the year during which the special study was made, as he had been for the three quarters preceding; during the following year, when records based on an analytical study of habits and attitudes were first available (see reference cited), he was reported one quarter or another as needing careful training in care of materials, but showing marked improvement in three habits involving promptness of motor reaction.

Thus, upon analysis of the case, John's basic difficulty proved to be the fact that he had been allowed to approach motor activities presupposing two or three years' training with no systematic preparation. He was in consequence but another child destined, though in all probability needlessly, to experience for a longer or a shorter time the discouragement which comes from inferiority.

In the course of individual psychological examination of the second-grade children, Mary was found to earn a remarkably high intelligence quotient despite her failure in motor tests. This failure proved to be consistent, characterizing all motor tests in year VII and upwards of the Stanford Revision.[10] It seemed desirable that special attention be given to training in motor activities, and her case was referred to the writer for special study. Information regarding the following points was sought: her motor ability as reflected in school subjects involving motor control and in motor tests; her physiological development and possible physical defects; her developmental history and heredity; and her response to special training in a motor subject. The procedure was similar to that followed in John's case.

In all activities which involved motor control Mary was below the average. The reports of the teachers were as follows: In gymnasium work she was slow and clumsy and did not respond well to rhythm. In art though she worked very earnestly she worked very badly, "wallowing" in color. In industrial arts her work was more encouraging; her attitude was good, and her difficulties, which might easily be due to lack of experience, would probably be subject to improvement. On the whole, her performance in the motor activities of the school confirmed the test results.

The results of the motor tests indicated that Mary was considerably above the norm for her age in tapping and showed

[10] She was unsuccessful in but three non-motor tests below year XII; and did as well proportionately in the tests for this year, where no motor tests are scheduled, as in those for year VII, among which are two such tests.

satisfactory ability in the form-board test, but was below the norm in strength of grip, and failed completely in the steadiness test. In the deficiency in both strength and motor control thus revealed was probably afforded a partial explanation of her motor inadequacies.

Normal physiological development was indicated by the physical tests, but defects were found to be present upon reference to the records of the physical examination. They were probably not sufficiently serious, however, to affect her motor activities. Taken as a whole, therefore, the tests and the examination of the physical records afforded little of significance toward the solution of the problem.

Data concerning Mary's developmental history and heredity brought out the fact that her father was admittedly weak in activities requiring manual skill.[11] Thus Mary's inferiority in school tasks involving motor control was but natural. Moreover, the family was Jewish; if weakness in motor performance is characteristic of the race, as some believe, her lack of skill had a further hereditary basis.

Fewer special writing lessons than planned were given; the program was postponed by illness and interrupted by absence. Yet, though she did not have a sufficient number of lessons to counteract the effects of her finger movement and the one-space-high writing required by her grade teacher

[11] Much interesting information regarding her literary and dramatic ability was secured. She had rhymed since two and one-half years of age, and had consistently given indication of literary talent.

During her subsequent school career she established for herself, first in the elementary school and later in the high school, a position of literary leadership. Her first productions to be printed, a poem and a story, were published in the school quarterly when she was but eight years old, and were the only contributions from the elementary school to the number in which they appeared. The poem is as follows:

The Blue Bird

And now on sapphire wings, thou art borne through
A larger sapphire of a purer blue.

There was much in Mary's heredity on both sides which would explain her unusual talent.

(despite its being more difficult for her to execute than a smaller hand), measurement of her efficiency in handwriting at the beginning of the special instruction and at the close showed some gain in speed; the first specimen averaged twenty letters a minute, and the second, about six letters more. Measurement did not show change in quality, however; specimens of her writing in the small hand would measure about quality 9 on the Thorndike scale.

To the information already given should be added the fact that not before this year, though in the second grade, had she been in school and had an opportunity for systematic training in motor activities. The full significance of this fact is apparent upon an examination of her subsequent school career. During the following year she was reported as showing particular improvement from two to four quarters each in fine arts, industrial arts, and penmanship, and as above average for one quarter in physical education.[12] During the second year the records were too fragmentary to give a satisfactory indication, though one report in fine arts and two in penmanship indicated achievement below the average.[13] The third year, with the exception of one quarter in physical education, she was consistently reported as average or above. Even the hereditary handicap seemed to yield when she had been in school long enough to receive a considerable amount of training.[14]

Thus Mary was facing, though in less extreme form, the problem that was John's, having been plunged into motor activities without the necessary rudimentary training, and this despite the fact that she was very probably somewhat less endowed than the average in motor ability.

[12] These reports and those for subsequent years were made in terms of the new system of records, previously described, or its revision.

[13] These were the only reports during the year of her work in motor subjects.

[14] Like John, Mary received reports showing some difficulty with motor habits. These continued for two years. The third year, however, she had no unfavorable reports of this character.

James was given a psychological examination at the request of his industrial arts teacher, who found it impossible to secure good handwork from him and wanted to know the causes underlying his deficiency. The psychological examination furnished but little information from the standpoint of which his motor difficulties could be understood, for he both succeeded and failed in motor tests. It did bring out clearly, however, his superiority in mentality and his indifference in attitude. The latter trait was so pronounced that it might very well have affected the intelligence score. He was referred to the writer for further examination and observation. Similar facts to those obtained in the case of Mary were sought, and the same general method was followed.

From the teachers' reports of his ability in the motor subjects, it was apparent that James was incompetent in motor activities; but mention was so frequently made of his instability and indifference as a factor in this deficiency that it was perplexing at the outset to tell which was the cause and which the effect. Thus, for example, his gymnasium teacher said that he had no coördination, but the lack was due in large part to carelessness and failure to apply himself.[15] The art teacher made a more elaborate report similar in character. His grade teacher supplemented the description of his work in physical education, and added other items of interest. He did not do well in rhythm, and, so far as physical exercises were concerned, was the poorest child in the room; but was good in any kind of work which did not require the use of his hands. On the whole he was rather indifferent and listless. Both she and the gymnasium teacher, however, spoke of his showing improvement. His industrial arts teacher, at whose request, as previously stated, he was examined, made the most unfavorable report. His work was thoroughly unsatisfactory and discouraging; for instance, a little cart which he had made and was taking home was so poorly constructed that by the time he reached home, not a nail was left in it. He had had special

[15] Yet he received a grade of "good" the first three quarters of the year, and only the fourth quarter a grade of "fair."

training in handwork for two years and had been allowed for the most part to follow his own interest in his industrial arts work, yet he had shown no improvement and still remained indifferent as to the quality of his product and as to the amount of material and time he had wasted.

The same combination of motor inefficiency and indifference was encountered by the writer in connection with the special instruction in penmanship. Only under pressure, which was resorted to after leniency had failed, did signs of improvement appear.

Though, because of the coöperation of these two traits, it was difficult to estimate with certainty the relative responsibility of each in the production of his incompetence, it seemed reasonable to suppose that James had a real motor difficulty; and also that this deficiency, exaggerated as it doubtless was by his attitude, was less than the quality of his achievement indicated.

That there was a genuine deficiency the results of several of the motor tests confirmed. His performance was inferior or wholly unsuccessful in the tapping, the tracing, and the steadiness tests, and also in the form-board. To secure data to show ability to handle the tracing test even slightly, a larger number of trials than usual was allowed;[16] yet the average of his records when many of the lower ones had been discarded was unsatisfactory. He failed completely in the steadiness test; only if allowed to use both hands and to support them as much as possible could he hold the stylus in the largest hole without making a contact. He showed normal development, however, in the tests for strength of grip and in most of the physical tests. His deficiency, therefore, appeared to be not in strength but in motor control.

The physical records contributed but one meager suggestion to the explanation of his motor inferiority. They indicated, on the whole, a rapid physical development; and possibly the muscular development had not been able to keep pace with it.

[16] His records were thus not comparable with those taken when the usual procedure is followed.

James' personal and family history contributed further information for the problem. Like Mary, James was of Jewish parentage. His development had been late in several respects. This fact and others that were ascertained pointed to the probable inheritance of a none too sturdy physique and the possible inheritance of nervous instability. Moreover, his arms were weak though he was strong in other respects and did not tire. Although relatives on the maternal side had excelled in sports, even winning prizes for athletic achievement, and he had been given special encouragement and opportunity in athletic activities, he seemed to be satisfied when he did poorly. Also, he was lazy physically, though absolutely fearless.

That James' deficiency could be considerably counteracted by the proper kind of training and method of procedure seemed very probable. As noted before, he was reported as showing improvement by two teachers and made some progress in penmanship when under pressure. Though this improvement did not show itself in the speed or the quality of his writing (the rate when first measured was twenty letters a minute, and the quality about 7), he did improve in ability to use the muscular movement,—he was even able at the last to write some words with correct coördination.[17] Moreover, when under observation by the writer in an industrial arts class, he showed considerable improvability in sawing.[18] In the hope that this improvability would be capable of extension to other aspects of his work, the recommendation was made that

[17] He was given 16 lessons; 10 were one-half hour in length and 6, fifteen minutes.

[18] The circumstances were as follows: When first observed he was sawing vigorously and heedlessly. Noticing finally that each pull of the saw was carrying him farther from his mark, he began to saw in reckless fashion from the opposite direction. When the piece fell off and disclosed a remarkably jagged edge, he rushed away to find a plane; and, returning, proceeded to chip off some of the irregularities. Upon the writer's suggestion that he begin a second task with care, trying to follow his mark and steadying the saw as he worked, he took considerable pains and succeeded fairly well. Moreover, he had similar success immediately afterward when sawing to a third line.

he be given a definite amount of drill work for each day until he could do the fundamental processes required for the simplest work in wood. His teacher, therefore, planned exercises in measuring, sawing, boring, and similar operations. She found subsequently, however, that he was exceedingly restive under this type of drill and only under the closest supervision accomplished results at all worth while. After the conclusion of the special study[19] he continued to be reported as below average in this subject, and indeed in all motor subjects except physical education, in which he received but one report as below average. The next year he was reported the first quarter as below average only in penmanship; and during subsequent quarters, with the exception of penmanship, only in fine arts.[20] Strangely enough he was not reported once in industrial arts or in physical education; however, in the recollection of the industrial arts teacher, who was interviewed when the follow-up study was made, he did not achieve sufficient proficiency in handwork to merit exemption from report.[21] The following year he entered another school, and further follow-up work was not attempted.[22]

Sufficient evidence seemed to have been collected, however, to indicate that James would never have adequate motor skill to produce handwork products the worth of which was at all commensurate with the time and effort consumed on his part or on the part of the teacher; and that in pursuing the subject he was developing habits altogether inimical to a happy school career. Thus James was but another child who had been doomed to continue from year to year a required subject from the pursuit of which there was accruing an ever greater and greater net loss.

[19] Shortly before the close of the second quarter.

[20] In this subject he received one report as below average.

[21] The reports for this year were made according to the new system of reports.

[22] Like John, James was below average in system the first semester of the year when the special study was made, though he showed improvement the second semester. Moreover, the next year he was reported as needing careful training in certain motor habits.

NOTES AND NEWS

FROM THE MINUTES OF THE PHILOLOGICAL CLUB, THE UNIVERSITY OF NORTH CAROLINA, CHAPEL HILL, N. C., DECEMBER 10, 1923

The members of The Philological Club of the University of North Carolina, believing that large numbers of their German colleagues will suffer for the necessities of life during the coming winter, and actuated solely by the motive of contributing what they can to the salvage of human vitality and intellectual production in a class that during times of need suffers the greatest privation and receives the least aid, hereby authorize their President to appoint a Committee of three, whose duty will be to secure from each member of the Club a pledge for whatever amount he will give, to be divided into four installments and collected at regular intervals during the remainder of the academic year, and forward the same to their German colleagues in the following manner:

The Committee will select from the faculties of German Universities a Professor of German, a Professor of Romance Languages, a Professor of one of the classical languages, and a Professor of English who may be known either personally or by reputation to members of the Club as willing to undertake the distribution of the Club's gifts; the Committee will forward one collection to each of the professors chosen, with the request that he put the same to the best use in relieving whatever want appeals to him as most urgent among teachers of his subject personally known to him, retaining for himself, if he so desires, as much as one-third of the amount sent him.

Realizing that their contributions will go but a very little way towards alleviating a great deal of suffering, the members of the Club hereby instruct their Committee to ask the editors of whatever publications the Committee may select, to publish these resolutions, in the hope that the Club's procedure in this instance may encourage like actions being taken by similar organizations throughout our country; and furthermore the Club instructs its Committee to secure the promise of the most available among those members of the Club who will attend the approaching annual meeting of The Modern Language Association to bring a similar resolution before that body.

BOOK REVIEWS

J. E. W. Wallin. *The Measurement of Mental Traits in Normal and Epileptic School Children*. Miami University Bulletin. Series XXI, no. 8, April, 1923. Miami University, Oxford, Ohio. Pp. 175. Price 75 cents.

This research was carried out with epileptic and normal school children during five successive months, and a comparison is made of the improvement of the children on the tests as they were given on the successive sittings. The normal children were pupils enrolled in the second to eleventh grades in the Hopewell New Jersey Public Schools and the epileptic children were in attendance at the New Jersey State School at Skillman. Seventy-six normal pupils were used in the experiment. They were selected subjectively by the teachers in each grade, the teachers selecting two bright boys and two bright girls, two average boys and two average girls and two dull boys and two dull girls from each grade. The 30 ablest epileptic children were selected from the State School. The epileptic children were older on the average than the normal children but they were inferior or less mature mentally as is shown by pedagogical status and by their mental age.

Extensive sets of group tests were used and a chapter is given to each test describing the test and giving the results of both the normal and the epileptic children. The tests were such as memorizing visually presented numbers, rapidity of thinking, addition tests, controlled association, attention and perception, observation, memory of logical and illogical association, recognition, and speed of motor reaction (instead of using the usual tapping test to determine motor speed, Dr. Wallin conceived the idea of having the subjects make circles).

As a result of these tests, Dr. Wallin concludes that the epileptic children made less improvement in genuine mental capacity than the normal children. Even after making the large gains registered in the tests, the epileptics were still inferior to the normals. The improvement of the epileptics as is given by the tests, show that the most profitable form of training for them should be sensory, motor and individual in character.

M. La Vinia Warner,
Ohio University.

ZENAS CLARK DICKINSON. *Economic Motives (A Study in the Psychological Foundations of Economic Theory, with Some References to Other Social Sciences.* Awarded the David A. Wells Prize for the year 1919–1920. Harvard University Press, Cambridge, 1922. Pp. vii and 304.

Economic Motives "grew out of a doctoral thesis presented at Harvard University in 1919 . . . ." The field that Professor Dickinson aims to cover "may be called the psychological problems and postulates of economics, which are most conspicuous, of course, in the matter relating to wants, self-interest, value, interest and wages." The main purpose of the book "is to gather up whatever material is to be found in psychological science that offers help in dealing with the above problems, and to present this material briefly in a manner intelligible to the economist or other social scientist" (p. v).

To say that Professor Dickinson has been successful in his undertaking would be folly. The book contains a sketch of certain phases of the history of psychology—which phases concern themselves chiefly with the psychologies which assume the existence of the instincts as fundamental human drives. Because Professor Dickinson found confusion in this realm of psychology he aimed to evolve and construct deductively his own set of fundamental human instincts. The attempt is a crude one—as, from similar failures of other economists, one might have predicted; in fact, it reminds the reader of the late Professor Parker's endeavors in the same realm. He fails to profit by his study of Hobbs while such men as Cabanis, Locke, Hume, Herder and Reinar are not even considered. In fact his attempted study of English empiricism omits some of the most important members of that school. Had Professor Dickinson studied these writers he would not have limited himself so exclusively and fatally to those psychologies which assume the existence of instincts as entities.[1]

Consequently, we find Professor Dickinson in the first two hundred pages of his book, discussing, and attempting to reduce the confusion among the writers on instincts, and in the remaining seventy pages suggesting in a highly speculative and deductive manner the application of the doctrine of instincts in the problems of economic theory, but always limiting himself entirely to a consideration of one school of psychology. There are a few cases when he finds that his notion of the existence of instincts does not always supply the necessary psychological foundations for the historical doctrines of the marginal economists. Then he proceeds to find other psychological notions and to shape these into the mold of the accepted economic categories. Thus, for example, he gives a new meaning to the psychological doctrine of feelings, in

[1] Cf. my article, Psychology in Economic Theory, to appear in the Journal of Political Economy.

order to save and securely ground the economic doctrine of diminishing utility. He makes them obey the Weber-Fechner law (pp. 233 to 235)—an undertaking not as yet accomplished by psychologists.

The value of the book to economists must be determined—we presume—by them alone. Whatever their judgments may be, the first two-thirds of the essay is helpful to the student of social psychology as a review of the present confusion in the field of instincts. It might constitute a useful review of one phase of "instinct-psychology" for the graduate student who is desirous of preparing for his master's examination.

A. J. Snow,
Northwestern University.

Charles Conant Josey. *The Social Philosophy of Instincts.* Scribner's Sons, New York, 1922. Pp. 274.

The task that Professor Josey sets himself in this expansion of his doctoral dissertation is to throw some doubt on the reality of instinct as forces, a matter concerning which there is so much disagreement at this time. To accomplish the above task he gives the reader a remarkably clear explanation of the theory of instincts as forces of action and that this misconceived theory has a basis in reality the author of the essay does not dispute; in fact, he tries to discover this basis. "What better explanation can be advanced than to regard [the wonderfully adaptive behavior of organism, the sublimity of man's moral ideas, his clear vision of right and wrong, etc.] as due to *instincts*, or the accumulated wisdom of the species? In brief, what other explanation can be given in a world of cause and effect? Thus, the old superstitions founded on belief in metempsychosis and theological speculations give place to 'scientific' explanations based on the assumption of ancestral memories, or of wisdom and habits acquired by the species. To discuss the transition from superstition to 'science' is the first task of this treatise. The connecting link is the feeling that certain activities cannot be adequately accounted for in terms of the individual's experience and capacities. To supplement explanations in these terms, various conceptions are invoked. However different these conceptions may be, all of them have this in common: instead of solving the problems connected with behavior, they transfer them to another realm. In one case the problems are transferred to a psychology of ancestral ghosts or spirits; in another, they are transferred to the realm of Divine psychology; and in another, they are transferred to the psychology of the species. Yet in no case have we reason to suppose that the new fields are more available for research than the field presented by the individual acting here and now in our very presence. The study of the similarities found in the belief in metempsychosis and in instinct will serve also to show the sources of the powerful sanction of instinct" (pp. 22 and 23).

The criticism of the use of instinct as a sanction is the second task of the author. Here he finds "that interpretations of behavior in terms of forces are not only unnecessary and unilluminating, but actually prevent a factual study of behavior on account of the mass of psychological impedimenta, whose origin furnishes such a fruitful cause for controversy. Behavior . . . . should be interpreted not in terms of forces but in terms of the relations the organism sustains to its environment. By so doing one gets close to the facts which should enable him to correlate the activities of an organism with the variable factors which determine that the organism shall act as it does rather than in some other way" (pp. 23 and 24).

The third task that Professor Josey assigns to himself is to giving a "brief statement of the point of view of the essay and . . . . [the] pointing out certain differences which should follow in social practices when the behavior of the individual is interpreted in terms of the give-and-take relations he sustains to his environment, rather than in terms of hidden forces that are released by a multitude of stimuli and that express themselves in a variety of responses" (p. 24).

To illustrate Professor Josey's point of view it may be well to give a number of his own examples, such as the following: "it has been found that passenger-pigeons ordinarily will not mate with ring-doves. Yet, if they are hatched by ring-doves, they will not only mate with ring-doves but will actually refuse to mate with pigeons. This difference in behavior cannot be regarded as due to innate differences between the pigeons that mate with pigeons and those that mate with ring-doves. The difference is clearly due to differences in their early experiences, or their psychological development. This truth may be further illustrated by a consideration of pigeons with reference to sex preferences. For instance, if male pigeons are raised with males only, they, at mating season, are attracted to the males, but they treat them as females. On the other hand, if a male is raised with females only, he will act toward the males at mating season as the females do. Here it is again obvious that innate tendencies throw little light on the behavior; for in these cases we have behavior that is quite different, and yet the innate characters are presumably the same. Nor is light thrown on this behavior by regarding it as due to the passing away of certain transient instincts and to the awakening of others. Such speculations are quite unnecessary, for the behavior is more intelligibly accounted for in terms of the known and observed experiences of the agents. Sex aberrations in man may be used to illustrate the same truth. The impressive fact that comes out in a study of the psychology of sex is that normal sex behavior and interest are as much a product of normal and favorable conditions as abnormal and objectionable sex behavior is the result of unfortunate and abnormal sex experiences" (pp. 211 and 212).

Again, Professor Josey asks: "Is work the result of an instinct? That work is the result of conditions under which one lives seems to be recognized by Veblen himself in accounting for the universality of work at the dawn of human society. Change the conditions and one's attitude toward work undergoes a profound change. And instinct that is thus dependent for its expression on environmental conditions might well surrender its rôle as a motivator of activity; for the real motivator seems to be the total situation. That there is no need for an instinct of this sort becomes apparent through the consideration that work is always for the purpose of realizing some desire. We work, not because we have an instinct to work, but because we live in a world that makes it necessary that we have purposes and make provision for the future. Place man in a world in which all his future wants are provided for, there would be little work. We work because we live in a world in which work is necessary. The attractiveness of the Garden of Eden lies to a great extent in the fact that there men lived in a world in which work was unnecessary. Men in such a world would not work if the habits of those living in the tropics may be taken as sufficient evidence of what men in general would do in a world freed of the necessity of work. In the tropics little work is necessary and little work is done. There is no necessity of confining our illustrations to remote tribes. Great numbers of men in our own communities, provided with ample means, do no work. This class of men is not confined to the wealthy. Men of moderate means prefer to live on a small income rather than work for a larger one. Even laborers show this disposition. It is a common complaint in the South that high wages for cotton-picking make it difficult to get the cotton picked, as this only affords the pickers a living for less work, and consequently they do less work. On the other hand, we have all observed many men of wealth hard at work. Are we to follow Veblen in regarding these men as cases of sporadic reversion to the primitive instinct? They can be much better accounted for in terms of the ideals and purposes that have been impressed on these individuals than in terms of a biological difference between them and other men of wealth. We may safely assume then that men work, not because of an innate urge to work, but because of necessity and of the ideals impressed on them. The necessities of men differ. What is a necessity to one man is gladly dispensed with by another, if he can save himself from working. On the other hand, men who have no need to work and yet do work are animated by high and big purposes. They are ambitious to become great. It is for this reason that we find men in all classes hard at work. But work in no case should be regarded as due to an innate urge to work. When it is not due to necessity it is due rather to the dynamic character of purposes, ideals, and ambitions which have arisen in the individual as a result of his contacts and training" (pp. 164 to 166).

Finally Professor Josey states the following conclusions—which we believe are warranted from the material presented in the essay—that "the conception of instincts and emotions as innate characters, which determine our activities, is a very arbitrary assumption and one which goes counter to all the facts of development and adaptation we have considered. For it has been shown that the development and activity of an organism are determined by its initial structure, its experience, physiological conditions, and the presented stimuli. There is no room in such explanations for instincts regarded as determiners of activity. Instincts are not to be regarded as determiners of behavior but simply as names for characterizing certain activities . . . ." (p. 223).

"Nor is there a store of energy or impulses in the organism seeking to find expression in various outlets. The energy or impulse comes into existence when there is a certain situation in the same way that iron glows when treated in a certain way, or that a certain explosive force comes into existence when the various elements composing nitroglycerine are combined in a certain way and then set off. It would be a mistake to regard the explosive force as existing in the nitrogen carbon, and other elements. It exists only in the combination, and then only when the combination is treated in a certain way. . . . . It is because we feel a necessity to explain 'in virtue of what' an organism acts that we posit within the organism various innate forces, somewhere acquired, which by various manipulations are supposed to account for the behavior as we observe it. This need would disappear if we would only recognize that activity does not need to be accounted for. Activity is the starting-point for science. All we hope to know is what determines the particular acts or forms of activity. In seeking to learn these it would be well to clear our minds of all expectation of greatly increasing our knowledge of the determinants of behavior by hypostasizing certain activities or responses into forces that are used as explanations of the various activities" (pp. 224 to 237).

The influence of the Columbia School of Philosophy upon Professor Josey's point of view is only too obvious—that the above conclusions are dealt with in a measure by Professor Dewey in his *Human Nature and Conduct* is known to Professor Josey—but that Doctor Josey's wish, as stated in his preface, is being fulfilled there is no doubt. His able presentation of his subject matter, no doubt, will help to "introduce a more critical attitude regarding the dogmatic claims of evolutionists."

Professor Josey's last paragraph, although not new in principle, is worth restating at this time because of its bearing upon our general theory of social progress: "Since our behavior, desires, and impulses are the results of our activities, determined by the give-and-take relations of the individual to his environment, the duty and rôle of intel-

ligence become clear. It is not to sit by in idle leisure in the hope that there is within us a guide fully competent and willing to direct and guide us. Its duty is rather to take an active part in the ordering of our behavior by varying the conditions that confront the individual so that the responses, impulses, and sentiments that are preferred shall dominate the characters of men."

A. J. Snow,
Northwestern University.

June E. Downey, Ph. D. *The Will-Temperament and Its Testing.* World Book Co., Yonkers, New York.

The attack on the problem of analyzing and measuring traits of personality has begun. Each year sees an increasing number of recognized psychologists applying the scientific method to what has heretofore been a profitable field for quackery.

At the present time the most unique and promising attempt to measure non-intellectual factors in personality is by all odds, Downey's Will-Temperament Test. Her book, *The Will-Temperament and Its Testing*, is an explanation of the genesis of the test, its use, and its significance. The test is the result of rare originality combined with years of painstaking experimentation.

Type responses of a contrasting nature were first recognized in experiments in muscle reading. From this beginning Dr. Downey has developed a series of twelve tests, which she combines into three groups. These are speed-tests, tests for aggressiveness, and tests for carefulness and persistence. There are obviously other important traits of personality untouched by these tests, such as honesty, for example. But temperament as used by Dr. Downey is one's characteristic activity determined by two factors, the amount of nervous energy at one's disposal, and one's tendency for immediate or inhibited discharge.

Handwriting is the medium of motor expression used in most of the tests, because practically every one knows how to write and this procedure leaves a permanent record of the muscular movement. Any other form of motor expression if feasible might be used according to Dr. Downey for the psycho-physical organism in a unit which expresses itself characteristically in all its various functions.

More significant than the standings in the individual tests is the will-temperament pattern which is indicated by emphasis on one or two of the three groups. Thus an individual who is low on the speed group and high on the accuracy group will do better school work than his score on the intelligence test would indicate. This supplementing of the much used intelligence tests is an important function of the will-temperament series. It explains many inequalities between achievement and capacity.

A reliable test of temperament would, of course, be immediately useful in many ways. One chapter describes the applications which have already been made of the Downey test in school work, court work, medicine and business.

Dr. Downey's critics have attacked the apparently uncritical way in which she has labeled the tests. "Flexibility," "Speed of Decision" are not specifically defined traits, but are used as names of tests. Dr. Downey states quite candidly the weak points of the tests but she advances three types of proof to show that they measure, to a degree at least, the traits named. These proofs are the identification of temperament patterns (called Will-profiles) under standard directions, the correlation of test results with personal estimates, and the relation of test results to recognized symptoms of psychopathic subjects.

One criticism of the test in the opinion of the writer is that a trained examiner is required. One is needed who not merely knows the test technique but one who is familiar with the background and the development of the test. This limits its use. In some of the tests a very real conflict of personalities occurs. This makes the personality of the examiner more of a disturbing factor than is the case in most tests.

The book is written in a delightful style, which is occasionally interrupted with citations of correlation coefficients. These mean little, lacking statements of the number of cases on which they are based.

A little humor in a scientific book is as rare as it is refreshing. The description of a group of people taking the tapping test is very pleasing

The reader finds himself classifying his own traits of temperament as he reads. In fact, one cannot go through the book without being stimulated to observe people more closely.

Dr. Downey has made a specific contribution to one of the biggest problems in psychology and in life.

JAY REAM,
Assistant Superintendent of Agencies,
Mutual Benefit Life Insurance Company
Newark, N. J.

C. A. HENDERSON. *Personal and Business Efficiency.* George H. Doran, New York, 1923. Pp. viii + 308.

It is possible to review this book from the point of view of the psychologist or of the business man seeking inspiration. The book is primarily intended to appeal to the embryonic and full-fledged business man and from their point of view may be considered very stimulating. But since the author is a professor of psychology and since this is a psychological journal I feel justified in criticizing this book on psychological grounds.

Convinced that "in the last resort there is no other way to business efficiency than through personal efficiency," the author takes up these

two types of efficiency side by side with special emphasis on the latter as being the more important since the former depends upon it. The book is written for the general public and for students for whose guidance the author has furnished outlines, notes and exercises at the end of each chapter. It may thus serve as a text for such a course in business schools. Since the fundamental appeal is to the general public the style and treatment is popular.

The first three chapters are introductory and deal with the increasing need and the ends of personal and business efficiency, the nature and training of our resources for efficiency. In the next chapter the author deals with the will and says with dogmatic assurance that "the first characteristic of the will is that it is free, possessing from itself the power to man the switch and alter the direction of our train of associated ideas. The second characteristic is that in doing this it exhibits a quality of reason or wisdom." Such a conception of will seems to be rather antiquated. The entire book is a curious mixture of a little psychology and much questionable material. Thus on page 81 the author speaks of the "instinct of caution" and in the next line "the instinct of rage" and on page 179 the commercial instinct, but on page 116 he returns for a while to psychology in presenting Dewey's analysis of the thought process. The book is run through with the kind of inspiration usually fed to business men: as "concentration, attention, therefore, increased and made ever more continuous, is the one and only way to will power" (p. 82), and on the same page "the wise man repeatedly says to himself, 'I can,' whereupon the impossible becomes possible;" thus giving the book a flavor of Couéism. At the end of the chapter on The Master Builder we find among the notes quotations from such varied sources as James, Royce, Münsterberg, Payot, *Power of Will* by Haddock, and *Keys to Success* by B. C. Forbes.

The discussion of memory, imagination, thought and emotion is in much closer accord with the views prevalent among scientific psychologists than that of the preceding chapter on the will and that of the following on Putting Originality into Our Work. In this chapter on originality the author quotes from Coué and others to bolster up the argument on the wonder working powers of *faith*. In the next three chapters the author gives a popular account of the formation of judgments, sound habits, and the development of physical fitness. The last part of the book deals with the paths of efficiency and includes discussions on the conduct of the day's work, coöperation through salesmanship, and two final chapters dealing with the personality, closing with a discussion of religion as necessary to a well-balanced personality.

It is to be expected that a book attempting to discuss in a popular style such topics as the will about which there is so much controversy

in psychology, mental efficiency and personality, subjects on which our scientific knowledge is so meager, will be necessarily vague and open to question. This book is no exception. It contains few facts but is brimful with authority, some good and others open to question on scientific grounds, the whole of undoubted popular appeal, however.

MAX MEENES,
Princeton University.

ARLAND D. WEEKS. *The Control of the Social Mind.* With introduction by Joseph Jastrow. D. Appleton & Co., New York, 1923. Pp. xviii + 263.

Speaking of social control through psychology, the author expresses the purpose of the book when he states at the end of the first chapter that "Psychology can indicate the mechanisms and resources; a social-moral conscience must set the course to be followed." In his own words his "purpose is to consider aspects of mind that have special significance for further social development and better ways of getting on together." By redirecting man's mind it is possible to construct a far better social environment than our present one. The author opposes social inflexibility and recommends the adoption of experimental attitude toward social problems. In Chapters 4 and 5 he shows that social progress is essentially a matter of breaking habit, and points out the tendency to cling to a concept "long after succeeding events have sucked away its substance" and urges that we define social terms with greater exactness.

In an illuminating chapter on The Psychology of Defense the author indicates the progressive refinement of defense methods in human social evolution. Here also is an analysis of the influence of propaganda. The chapter following deals with the necessity and basis for coöperation. In discussing the need for an enlightened citizenship active in public affairs as the keystone of democracy, the author shows how little developed is "the art of reporting on public business," how little opportunity the citizen has to instruct his representative and how "civic lethargy results in part from lack of knowledge, which in turn is related to lack of means of effective communication touching public business" (p. 99).

The second part of the book takes up the Social Mind at Closer Range and opens with chapters on instinctive tendency and expression of motives. As instinctive tendencies to behavior the writer discusses instinctive partisanship and the instinct of adventure which would not ordinarily be included in a more rigid classification of instincts, the tendency to physical activity, mental activity, instinct of curiosity with which he appears to couple what he calls the searching instinct, then takes up the fighting tendency, rivalry, display, instinct of fear which is more generally assumed to be an emotion, and the instinct of play which is in reality not a distinct instinct but a combination of

other tendencies. Although it is hard to find a definition of instinct which will include all expressions the author discusses under that name, yet his treatment is very lucid and informing for the layman. The discussion of social memory is of special value for the intelligent citizen lacking in psychological knowledge. In order that we break loose from evil precedent the writer recommends that the historical past be neglected. Then follows a chapter on the art of accuracy which is essentially a plea for careful observation of social phenomena. The next chapter deals with suggestion and group behavior. The author finishes with a discussion of fatigue and urges the conservation of individual powers in order that there may be a surplus of energy to take up more effectively the individual's civic responsibilities.

This book is a valuable contribution to the *Conduct of Mind Series*. While some of the contents will not bear up too well under psychological scrutiny, it is nevertheless an able survey for the layman of the available psychological material underlying the control of social forces.

MAX MEENES,
Princeton University.

D. STARCH. *Principles of Advertising*. A. W. Shaw Co., New York. Pp. vii + 998.

The author has undertaken to bring together in one treatise the available material, from empirical and practical business sources, on the various questions which may at one time or another trouble the advertiser. The book is divided into six parts the first of which is introductory and includes an account of the history and development of advertising with its place in business; the second attempts an analysis of markets and methods of determining the individuals in the community to whom a given commodity may be sold; the third part deals with experimental and statistical analyses of the various possible appeals with methods of determining their comparative merits based on analysis of human nature, with chapters on sex and group differences; the fourth deals with methods of presenting appeals including a chapter on the use of suggestion and argument in advertising, one on the practical ethics of truth in advertising and chapters dealing with headlines, illustrations, size, color, layout, use of trade-marks and cartons and labels; the fifth deals with advertising mediums; and the sixth with various special types of advertising including national, retail, foreign and financial. The book is very comprehensive and is of value in that it emphasizes the use of experimental and statistical methods in advertising.

Early in the book the author gives a concise account of the development of advertising from the earliest known records to the present stage of constant increase in the use of research methods. He points

out statistically the remarkable growth in number and circulation of periodicals concurrent with the increasingly proportionate use of advertising space. Today there is much competition in advertising and so vast a sum of money is spent annually in this enterprise that it is obviously of great importance to develop experimentally methods to make advertising more effective and so most economical, thus helping to eliminate the waste accompanying unscientific advertising. Perhaps one of the important forms of waste which the author neglects to mention is that due to competition among advertisers which results in each firm attempting successively to outdo its competitors in volume of advertising. The book places a healthy emphasis on quality rather than on wasteful quantity and this can come about only through the application of scientific methods. On page 57 the author points out that the cost of advertising does not add to the price of the article but it would be of some interest to show in this connection that advertising is sometimes effective in enabling a manufacturer to sell an article at large profit by creating enormous demand for the article as in the case of the Gillette razor or the cranberry campaign which resulted in "bringing the record price of $22 a barrel" which the author cites on page 68 in another connection. In other instances the author shows that advertising is influential in reducing the price and improving the quality of a commodity. Probably the price depends in part on the attitude of the advertiser toward society.

The author points out the necessity of securing facts pertaining to the distribution of population and then goes on to discuss the use of the questionnaire method in gathering preliminary data for the advertiser. Much useful information can readily be secured by careful use of a judiciously prepared questionnaire and so the author recommends its extensive use to determine such basic factors as the preference of mediums of the customer, types of appeal, habits of buying, brand preferences, affective values of trade marks, various types of headlines, pictures, discovering uses of a product, etc. A number of sample investigations are included to illustrate the value and methods of application of the questionnaire. When he attempts an analysis of human nature the author presents a list of instincts which can hardly be justified on psychological grounds but which may serve as a basis for the advertiser. The relative strength of these instinctive incentives to action was determined by a study made with a large number of individuals using the rank method. The rank method is also used to determine the relative value of a number of possible selling arguments.

The discussion of suggestive advertising is very illuminating and much interesting psychological data is cited to show the importance of ideomotor action and suggestion. Much experimental data is presented to show the effectiveness of suggestive advertising the importance of

which is demonstrated by its steadily increasing use. The following chapter presents a scientific account of the value and methods of use of argument in advertising, especially to put across a new product to the buying public. The discussion of truth in advertising is of great interest and the author points out that there is an unmistakable tendency to eradicate untruthful and misleading advertising, but greater emphasis might perhaps be laid on the fact that the most effective argument for truth in advertising is to prove conclusively that it pays in actual dollars and cents to the advertiser.

In a series of important chapters rich in statistical and experimental material, we find much good data on the use and most effective forms of headlines, color, layout, size, form and illustrations of advertisements. In some of the experimental material it is virtually impossible to account for all the selection factors when one aspect of a complete advertisement is tested for, as in studying the effect of size, but the author ruled out selection in part by making the test advertisements as nearly similar as possible varying only the quality tested for. So instead of using a series of ads varying in size it would have been more indicative to use ads as nearly alike as possible except in the matter of size. The author goes on further to present results of psychological studies on the affective value of color and form and of position. The last section of the book is devoted to a discussion of special fields of advertising with a treatment of national, retail, foreign and financial problems.

The book was apparently put together in great haste, making the author's meaning in parts rather difficult to get at; thus on page 918 the sequence of lines is so unusual as to make the meaning very difficult of understanding. In table 162, page 923, the columns "customer readers basement" and "customer readers upstairs" are interchanged, thus making the table read the exact opposite of what the author tries to convey in the text. Such work may be excusable in a daily newspaper which must be put together in a hurry, but one hardly expects to meet with it in a careful compendium. The book contains a vast amount of material of value to advertisers of all description; let us hope that the author will not mar the companion volume on advertising problems which is now underway by any such haste as marks this book.

MAX MEENES,
Princeton University.

M. V. O'SHEA. *Tobacco and Mental Efficiency*. Macmillan Co., New York, 1923. 258 pp.

In coöperation with the Committee to Study the Tobacco Problem Professor O'Shea, of the University of Wisconsin, has prepared a very comprehensive and impartial summary of available data and opinions

with regard to the effects of the use of tobacco upon mental characteristics and scholarship, and has combined with this compilation the results of some extended laboratory experiments of his own. The book is made up of three parts. Part I presents data derived from observation, introspection, and biography; Part II summarizes data chiefly statistical derived from school and college records; Part III presents Professor O'Shea's laboratory findings. An extended bibliography is appended.

The conclusions of the study are summarized separately for mature and for immature persons. Professor O'Shea concludes from the laboratory tests that, for mature persons "the results show that tobacco tends to retard and to disturb intellectual processes but not in the marked degree in the case of the particular functions which were investigated." As to the effects upon immature persons, the data and opinions collected by Professor O'Shea point quite conclusively to the damaging effects upon character and scholarship of the early use of tobacco.

The laboratory and statistical technique employed by Professor O'Shea commend themselves in their impartiality and care. Particular pains were taken in the laboratory tests to eliminate extraneous factors such as suggestion. The subjects experimented upon were blindfolded and were allowed to smoke, in the different sessions, two different pipes, one of which contained tobacco and the other of which was cleverly contrived to give the sensations of smoking without the use of tobacco in the pipe. The conclusions of the experiments were based upon differences in various tests and measurements when the subject was actually smoking and when the control pipe was used.

From a statistical standpoint, the care with which Professor O'Shea endeavored to ascertain the reliability of the differences between the measurements obtained deserves special commendation. One or two queries arise, however, in the mind of the reader. In two or three instances, a reduction of over 100 per cent in a given measure is shown For instance, on page 197, table D indicates that subject number 14 lost 182 per cent in steadiness of muscular control when smoking tobacco The statement of losses of over 100 per cent must mean that the scales used were not adjusted so as to have the zero point at absolute zero. For many of the characteristics no absolute zero exists. The reduction of the observed differences to the percentage basis is therefore decidedly misleading. In order to have the results comparable, it would be desirable to show the effects of tobacco in terms of multiples of the standard deviations of the measures used. To say that tobacco increases the pulse rate by an average of 6 per cent and increases muscular fatigue 6 per cent, gives a probably illusory sense of the equivalence of the effect in these two cases; whereas, if the statement were made that tobacco

increases the pulse beat by one standard deviation and muscular fatigue by one standard deviation, the comparison would be valid.

In the Summary Table on page 222, the general average effect on muscular fatigue is given as −5.76, whereas on page 199, the same item is given as +5.76. The reversal of sign in the summary table means an unfortunate reversal in conclusion on an important aspect of the investigation.

It seems clear that Professor O'Shea's book becomes the authoritative summary statement in this field. No one who is interested in the effects of narcotics upon mental processes or upon character can afford to ignore it.

HORNELL HART,
University of Iowa.

H. E. BUCHHOLZ. *Of What Use Are Common People? A study in democracy.* Warwick & York, Baltimore, 1923. 251 p.

The animus of Mr. Buchholz' may be suggested by a quotation from his preface:

"A group of psychologists devised a series of mental tests to be used on the men drafted for military service with the view to placing each individual in that branch of service for which he seemed best fitted and also for selecting draftees of supposed mental superiority who might profitably be schooled as officers. How far these tests served their intended purpose has apparently been ignored as a matter of slight consequence, while the data produced by the testings have been accepted as altogether reliable and are being freely interpreted, by scientists and laymen, to indicate that an amazingly large percentage of the entire population is incapable of mental development past that of a twelve year old child. . . . .

"No matter where the contemporary reader turns—to newspapers, to magazines, or to books—he finds this kind of disturbing analysis of the American people coupled with the suggestion, veiled or open, that democracy as democracy has heretofore been understood is a dream fast turning into a nightmare."

The motivation of the book appears to be a strong emotional reaction against the emphasis upon individual differences which has grown out of the mental test movement and in particular against the proposal to adjust education in accordance with mental capacity, and the proposal to combat the excessive fecundity of the less intelligent classes by the spread of the knowledge of birth control. No organized data and no scientific criticism are used in the course of the somewhat rambling argument.

HORNELL HART,
University of Iowa.

NEW BOOKS AND PAMPHLETS RECEIVED[1]

Books and pamphlets for review should be sent to James P. Porter, Department of Psychology, Ohio University, Athens, Ohio.

ALLPORT, FLOYD H. *Social Psychology*. Houghton Mifflin Co., New York. 451 pp.

ALEXANDER, F. MATTHIAS. *Constructive Conscious Control of the Individual*. E. P. Dutton & Co., New York City. 317 pp.

BARRY, F. R. *Christianity and Psychology*. George H. Doran Co., New York. 195 pp.

BENNETT, HENRY EASTMAN. *Psychology and Self-Development*. Ginn & Co., New York. 296 pp.

BOVET, PIERRE. *The Fighting Instinct*. Dodd, Mead & Co., New York. 252 pp. Price $4.00.

BUCHHOLZ, H. E. *Of What Use Are the Common People?* Warwick & York, Baltimore, Md. 251 pp. Price $2.00.

Educacion, Revista Mensual. Vol. II, No. 5. Apartado Postal, 1954, Mexico, D. F.

COOLEY, CHARLES HORTON. *Social Process*. Charles Scribner's Sons, New York City. 430 pp.

DOWNEY, JUNE E. *Will-Temperament and Its Testing*. World Book Co., Yonkers, New York. 339 pp.

FOSTER, WILLIAM S. *Experiments in Psychology*. Henry Holt & Co., New York. 309 pp.

FRANZ, SHEPHERD IVORY. *Nervous and Mental Re-Education*. Macmillan Co., New York. 225 pp.

FREEMAN, FRANK N., AND DOUGHERTY, MARY L. *How to Teach Handwriting*. Houghton Mifflin Co., New York. 305 pp. Price $1.80.

FULLER, RAYMOND G. *Child Labor and The Constitution*. Crowell Publishing Company.

FOLMER, ANTH., AND GERRITSZ, J. *Tijdschrift Van Den Nederlandschen Werkloosheilds-Raad*. Vols. 10 and 11, 1923. Bureau: Kloveniersburgwal 70, Amsterdam.

GESELL, ARNOLD. *The Pre-School Child*. Houghton Mifflin Co., New York. 264 pp.

HINKLE, BEATRICE M. *The Re-Creating of the Individual*. Harcourt, Brace & Co., New York. 464 pp.

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[1] Mention here does not preclude further comment.

HOLLINGWORTH, H. L., AND POFFENBERGER, A. T. *Applied Psychology*. D. Appleton Co., New York. 431 pp. Price $2.50.

MAY, JAMES V. *Mental Diseases*. Richard G. Badger, Boston, Mass. 544 pp. Price $5.00.

MONROE, WALTER S. *Present Status of Written Examinations and Suggestions for Their Improvement*. University of Illinois Bulletin, Urbana, Ill. 77 pp.

O'SHEA, M. V. *Tobacco and Mental Efficiency*. Macmillan Co., New York. 258 pp.

PRESCOTT, DANIEL ALFRED. *Determination of Anatomical Age in School Children and Its Relation to Mental Development*. Harvard Monographs in Education, July, 1923. Harvard University, Cambridge, Mass. 59 pp.

REYMERT, MARTIN L. *Development of a Verbal Concept of Relationship in Early Childhood*. Scandinavian Scientific Press, Kristiania, Norway. 83 pp.

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